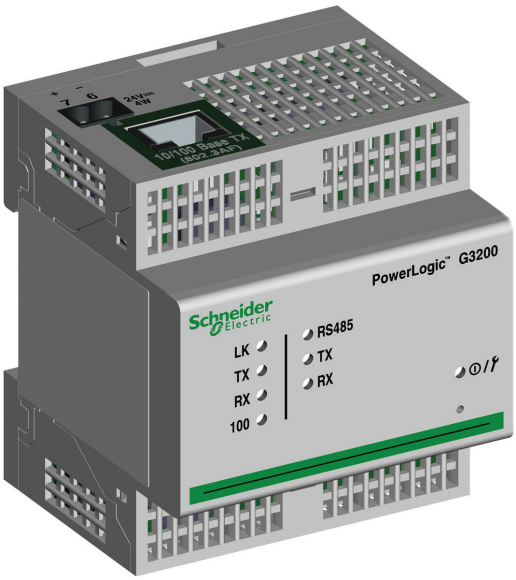
PowerLogic™ Ethernet Gateways

PowerLogic G3200
Modbus-to-IEC 61850 Server

User's manual
12/2010



Schneider Electric

Safety instructions

Safety symbols and messages

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

ANSI symbol. *IEC symbol.*

Risk of electric shock

The addition of either symbol to a “Danger” or “Warning” safety label on a device indicates that an electrical hazard exists, which will result in death or personal injury if the instructions are not followed.

Safety alert

This is the safety alert symbol. It is used to alert you to potential personal injury hazards and prompt you to consult the manual. Obey all safety instructions that follow this symbol in the manual to avoid possible injury or death.

Safety messages

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result** in death, serious injury or property damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **could result in** death, serious injury or property damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **could result in** minor or moderate injury or property damage.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **could result in** property damage.

Restricted liability

Electrical equipment should be serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this manual. This document is not intended as an instruction manual for untrained persons.

Device operation

The user is responsible for checking that the rated characteristics of the device are suitable for its application. The user is responsible for reading and following the device’s operating and installation instructions before attempting to commission or maintain it. Failure to follow these instructions can affect device operation and constitute a hazard for people and property.

Protective grounding

The user is responsible for compliance with all the existing international and national electrical codes concerning protective grounding of any device.

PowerLogic G3200
Modbus-to-IEC 61850
Server

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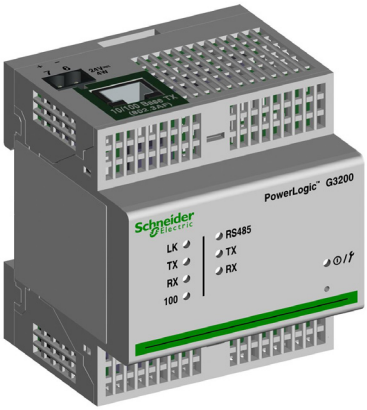


PowerLogic G3200: Modbus-to-IEC 61850 server.

Introduction

IEC 61850 is a standard for communication networks and systems in electrical installations.

Using the PowerLogic G3200 Modbus-to-IEC 61850 server, the majority of Modbus communicating devices can be connected to an IEC 61850 station bus and benefit from advanced features such as efficient time management, meaningful and optimized data retrieval, and simultaneous support of devices over Modbus TCP.

Application and benefits

The G3200 offers the following benefits:

- highly-accurate time-stamped data and associated time synchronization with the source,
- facilitated retrieval of meaningful information,
- enhanced security control model,
- optimized network bandwidth usage,
- easy integration into IEC 61850 systems,
- simultaneous support of Modbus TCP and IEC 61850, with the ability to connect legacy Modbus TCP-based tools in parallel with IEC 61850 communication.

Advanced time management

The G3200 provides highly-accurate time-stamped data and associated time synchronization with the source, using 2 methods:

- SNTP clock synchronization, which enables the device to synchronize automatically its own clock from a clock server, located on the Ethernet network. Clock synchronization can reach a few milliseconds depending on the accuracy of the SNTP source.
- Downstream local source synchronization.The G3200 can synchronize a downstream Modbus device and then obtain data directly time-stamped at the source to provide superior time-stamp accuracy. This feature is available only for some Modbus device types.

Meaningful data retrieval

The G3200 leverages the benefits of the IEC 61850 standard and offers the possibility for customization to provide advanced data retrieval:

- The G3200 translates raw information from the Modbus device into meaningful information using the IEC 61850 standard dictionary, which covers most electricity-related data.
- The translation rules are defined in a configuration file, which is loaded into the G3200. When the translation is done and verified, the translation engine becomes independent from the application.
- The configuration files can be customized to meet your specific system's needs.

Secured control model

The G3200 server supports control models as defined by the IEC 61850 standard to provide direct or secured control operations to the Modbus device.

Optimized network usage

The G3200 optimizes the network usage by using a standard event-driven communication service. This mechanism overcomes a disadvantage of the Modbus TCP network as typically the master is forced to poll the Modbus slaves to check for any updated information. Using the G3200, the device is able to automatically push data only when a selected trigger has been reached.

Easy integration into IEC 61850 systems

The configuration files loaded in to the G3200 and corresponding Modbus devices are IEC 61850 compliant and so are easily manageable by any IEC 61850 system configuration tool.

Simultaneous support of Modbus TCP and IEC 61850

The G3200 not only provides the communication benefits offered by the IEC 61850 protocol, but also ensures inter-operability of these devices in a Modbus TCP system.

The G3200 offers compatibility with:
- IEC 61850-6 (SCL Substation Configuration Language)
- IEC 61850-7-1 (modelling concepts)
- IEC 61850-7-2 (ACSI Abstract Communication Service Interface)
- IEC 61850-7-3 (common data classes)
- IEC 61850-7-4 (Logical Nodes data and attributes)
- IEC 61850-8-1 (mapping on Ethernet-based communication networks)

IEC 61850 main features

Support of IEC 61850 modelling concepts

The G3200:

- supports IEC 61850 standard LNs (Logical Nodes), data objects and CDCs (Common Data Class). See MICS - Model implementation conformance statement, page 31.
- provides extended LNs, CDCs and data objects to leverage additional features of the Modbus devices.
- enables the use of configurable data sets and report control blocks to meet the needs of your system.

Support of IEC 61850 communication services

The G3200 supports standard server-client mode communication including buffered reports and control services. See ACSI description, page 28.

Modbus translation engine

The G3200 supports translation rules for converting the most common data types from a Modbus register base approach to the highly structured and named approach of IEC 61850:

- The translation rules are defined within a CID (Configured IED Description) file, using SCL language, as a sequence of identifiers that specify the address of the registers, format of the register content and logic process codes specifying the mathematical and logic operations to be performed on the register content to convert the data to be IEC 61850 compliant.
- Data conversion and storage are done by the polling and decoding engine inside the G3200.
- At build time, the CID file, which describes the real capabilities of the Modbus device as well as the translation rules from Modbus to IEC 61850, has to be downloaded into the G3200 to make it operational.
- At run-time, the G3200 automatically polls some defined Modbus zones specified in the CID file and populates an internal cache. From this internal cache, the G3200 is able to answer IEC 61850 communication requests, to build datasets as requested in the CID file, and also to detect changes when they occur.

Note: *To assist the modelling process, the encoding rules are explained in a separate appendix. See Processing codes, page 59.*

Ethernet main features

The G3200 supports:

- HTTP protocol and embedded web server for configuration and diagnostic purposes
- FTP protocol for CID file download and upload
- SNTP protocol for time synchronization with the system
- SNMP protocol with MIB II reading support only for Ethernet network monitoring
- security features for connection over Ethernet:
  - user account and access definition for the access of FTP folder and web pages
  - IP filtering mechanism for Modbus TCP and IEC 61850 links which restricts or allows connection with the specified clients.

Transparent Ready main features

The G3200 provides class B15 level of service as defined by Transparent Ready for Ethernet links.The G3200 supports:

- Modbus TCP data exchange (read/write)
- Modbus TCP identification request
- web server based communication configuration (for example, hardware and baud rate settings)
- duplicate IP address detection
- web server based diagnostic help

Modbus serial link communication features

The G3200 also supports advanced services such as:

- identification request to check that the connected device is the right one.
- time synchronization (except PXP, ELA, ION meter and Power Meter Series 200/700.)
- TeSys T, Sepam and Easergy T200 time-stamped events retrieval
- PowerLogic Circuit Monitors and Power Meters alarms retrieval
- Micrologic alarms retrieval
- optimization of RS 485 link bandwidth by defining the refresh rates of Modbus objects received inside the G3200. See Specific syntax and rules for mapping Modbus devices, page 49.

Secured control support

An IEC 61850 client can force some control on the Modbus device using either:

- Direct control: normal security model very similar to the service offered by the Modbus write service.
- Select Before Operate (SBO): mechanism providing enhanced security by using a secured handshake between the client and the device to check that the control is requested by the client. SBO is handled at the G3200 level.

Multiple time management

The G3200 clock is synchronized from an SNTP clock server on the Ethernet network and receives the UTC time reference. The G3200 also has:

- available settings to manage local time (time zone, day light saving),
- ability to synchronize the clock of different types of devices such as Sepam, Easergy T200, Circuit Monitors and Power Meters.

Analogue deadbanded values, status changes and the detected alarms in the PXP, Circuit Monitors, Power Meters and Micrologic are time-stamped at the G3200 level with the G3200 clock.

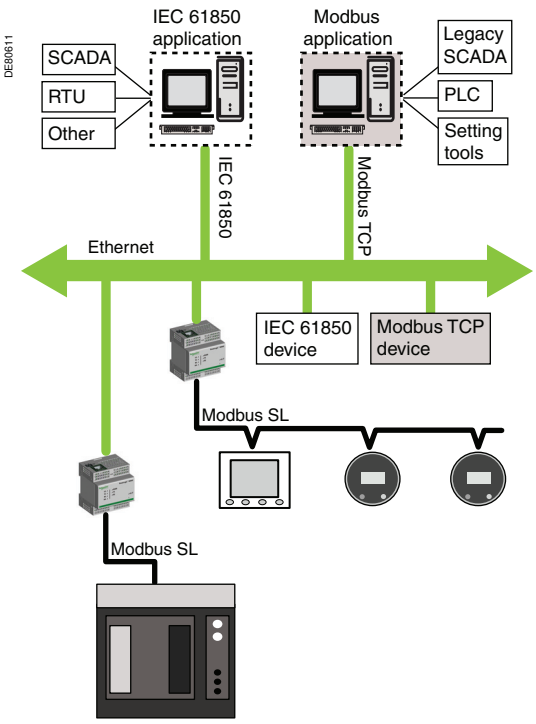
The time-stamps for the events (for example, protection, trip, I/O) inside the Sepam, TeSys T and Easergy T200 devices are taken from the device itself and so time accuracy depends on the device's time management capabilities.

G3200 features supported for different device types

The table below summarizes the features supported for the different types of devices. The list of devices given is not exhaustive nor restricted.

Device name	Real-time data	Control	Time-stamped events at device level	Time synchronization at device level
Micrologic A for Masterpact and Compact NS	■	■		
Micrologic P/H for Masterpact and Compact NS	■	■	■	■
PowerLogic Power Meter Series 200/700	■	■		
PowerLogic Power Meter Series 800	■	■	■	■
Easergy T200	■	■	■	■
PowerLogic Circuit Monitor Series 4000	■	■	■	■
Sepam 2000	■	■	■	■
PowerLogic ION Series 7000/8000	■			
TeSys T	■	■	■	■
PXP	■			

Presentation
Typical architecture



IEC 61850 architecture.

IEC 61850 basic architecture

Using the G3200, most types of Modbus devices can be plugged into an IEC 61850 basic architecture.

The recommended architecture is to attach one G3200 to one Modbus device.

If the G3200 is connected to multiple Modbus SL devices, the user must take into account the following impacts of this type of architecture:

- Configuration files must be customized to create as many Logical Devices as there are Modbus SL devices connected downstream to the G3200.
- Time performance is reduced. See G3200 performance indicators for different device types, page 5.
- Required cache memory is increased to support more complex Modbus IEDs and the additional logical device that represents the G3200 itself.

From an application point of view, this type of architecture is usually made of at least:

- one IEC 61850 client (the G3200 acting as a server),
- one clock server (SNTP),
- one file client (FTP) used at the configuration phase.

Ethernet architecture

- The recommended Ethernet architecture is a self-healing Ethernet ring backbone based on the IEEE 802.1d2004 RSTP protocol.
- The G3200 server is connected to an Ethernet switch using 10/100BASE-T copper wire (radial connection).

IEC 61850 and Modbus TCP mixed architecture

Because the G3200 can simultaneously support IEC 61850 and Modbus TCP protocols, the G3200 can also be connected to Modbus TCP masters such as setting tools, legacy SCADA or RTU/Controllers.

G3200 performance indicators for different device types

The table below gives performance indicators for different types of devices. The figures are given as an indication only: performance levels can vary depending on the chosen architecture.

Device name	Typical response delay of Modbus device	Typical time-stamping accuracy	Typical number of devices
Micrologic A for Masterpact and Compact NS	80 ms	N/A	2
Micrologic P/H for Masterpact and Compact NS	110 ms	630 ms	1
PowerLogic Power Meter Series 200/700	12 ms	N/A	2
PowerLogic Power Meter Series 800	7 ms	1000 ms	1
Easergy T200	12 ms	805 ms	3
PowerLogic Circuit Monitor Series 4000	3.5 ms	1000 ms	1
PowerLogic ION Series 7000/8000	24 ms	N/A	2
Sepam 2000	3 ms	N/A	2
TeSys T	8 ms	1000 ms	1
PXP	104.8 ms	N/A	2

Note: *N/A: feature not available with this device.*

Installation and configuration
Implementation steps

The availability of a configuration file (CID) is a pre-requisite for G3200 implementation.The CID file is essential as it contains the configuration of the communication data for all the Modbus devices connected to a G3200. The build of the CID file can be performed off-line. See Creating a CID file, page 44.

The installation and configuration of the G3200 server itself involves the following 3 main steps:
- Installing the hardware
- Configuring the communication services
- Downloading of the appropriate configuration file (CID) into the G3200.

If required, tools are available on board for monitoring, tuning and troubleshooting the product. See Monitoring and troubleshooting, page 21.

Installing the hardware

Installation of the hardware involves mounting the G3200 and wiring it to the RS 485 network. See Installation, page 7.

Configuring the communication services

Configuration of the communication services involves configuring the G3200 Ethernet and Modbus communication capabilities. This process includes configuration of the Ethernet port and IP based protocols (IP address, security, clock management, etc.). It also includes the configuration of the Modbus Master port. See Configuration, page 10.

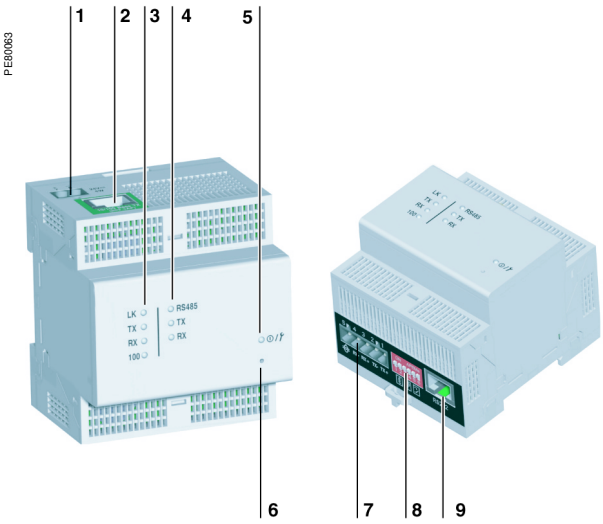
Downloading the configuration file (CID) into the G3200

Downloading the appropriate CID file into the selected G3200 is the final step in making the G3200 ready for IEC 61850 communication. To ensure the correct operation of the CID file, it is checked by the G3200 before being taken into account. See Download of CID file, page 19.

Preparation for installation

This section contains information useful for preparing the installation of the G3200.

Description

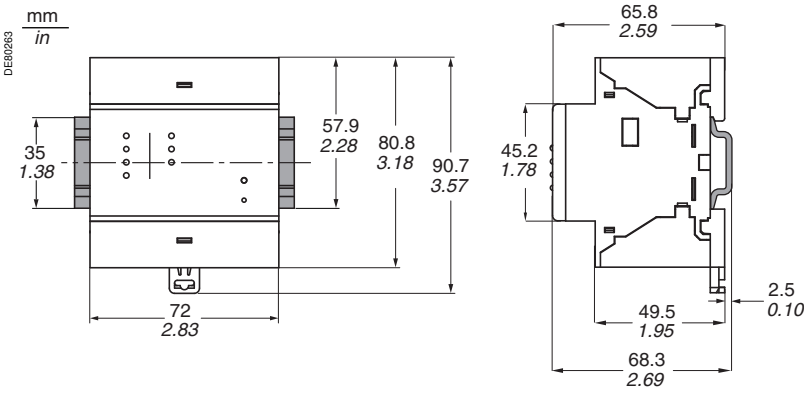


1 ⓘ/🔧 LED: power-up/maintenance
2 Standard LEDs:
- ■ RS 485 LED: network link active
- □ On: RS 485 mode
- □ Off: RS 232 mode
- ■ Flashing green Tx LED: G3200 transmission active
- ■ Flashing green Rx LED: G3200 reception active

3 Ethernet LEDs:
- ■ LK green LED on: network link active
- ■ Flashing green Tx LED: G3200 transmission active
- ■ Flashing green Rx LED: G3200 reception active
- ■ 100 green LED:
- □ On: 100 Mbps network speed
- □ Off: 10 Mbps network speed

4 10/100 Base Tx port for Ethernet connection by RJ45 connector
5 Connection of the 24 V DC supply
6 Reset button
7 RS 485 connection
8 RS 485 parameter-setting selector switches
9 RS 232 connection

Dimensions



Characteristics

PowerLogic G3200	
Technical characteristics	
Weight	0.17 kg (0.37 lb)
Assembly	On symmetrical DIN rail
Power supply	
Voltage	24 V DC (± 10%) supplied by a class 2 power supply
Maximum consumption	4 W
Dielectric withstand	1.5 kV
Environmental characteristics	
Operating temperature	-25 °C to +70 °C (-13 °F to +158 °F)
Storage temperature	-40 °C to +85 °C (- 40 °F to +185 °F)
Humidity ratio	5 to 95% relative humidity (non condensing) at +55 °C (131 °F)
Degree of pollution	Class 2
Tightness	IP30
Electromagnetic compatibility	
Emission tests	
Emissions (radiated and conducted)	EN 55022/EN 55011/FCC Class A
Immunity tests - Radiated disturbances	
Electrostatic discharge	EN 61000-4-2
Radiated radiofrequencies	EN 61000-4-3
Magnetic fields at the network frequency	EN 61000-4-8
Immunity tests - Conducted disturbances	
Fast transient bursts	EN 61000-4-4
Surges	EN 61000-4-5
Conducted radiofrequencies	EN 61000-4-6
Safety	
International	IEC 60950
USA	UL 508/UL 60950
Canada	cUL (complies with CSA C22.2, no. 60950)
Australia/New Zealand	AS/NZS 60950
Certification	
Europe	CE
2-wire/4-wire RS 485 communication port	
Electrical interface	
Standard	2-wire or 4-wire differential RS 485 EIA
Maximum number of devices per G3200	32
Daisy chain maximum distances	
Maximum distance for 1-16 devices	3048 m (10,000 ft.) when Baud rate 9600 1524 m (5,000 ft.) when Baud rate 19200 1524 m (5,000 ft.) when Baud rate 38400
Maximum distance for 17-32 devices	1219 m (4,000 ft.) when Baud rate 9600 762 m (2,500 ft.) when Baud rate 19200 457 m (1,500 ft.) when Baud rate 38400
Modbus communication port	
Mode	Master
Baud rate	9600, 19200 or 38400
Parity	Even or Odd
Ethernet communication port	
Number of ports	1
Type of port	10/100 Base Tx
Protocols	HTTP, FTP, SNMP (MIB II), SNTP, ARP, IEC 61850 TCP/IP
Maximum number of simultaneous IEC 61850 open connections	6
Maximum number of simultaneous Modbus TCP open connections	4
Transmission speed	10/100 Mbps

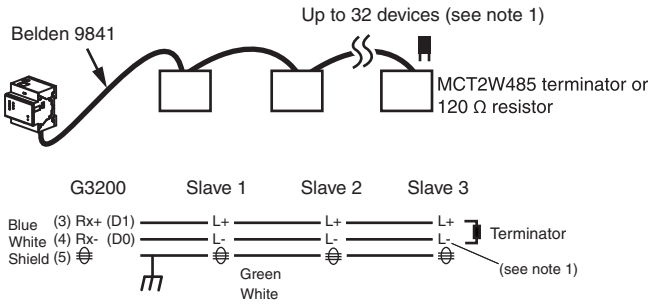
Hardware installation

Connecting the G3200: recommended connection

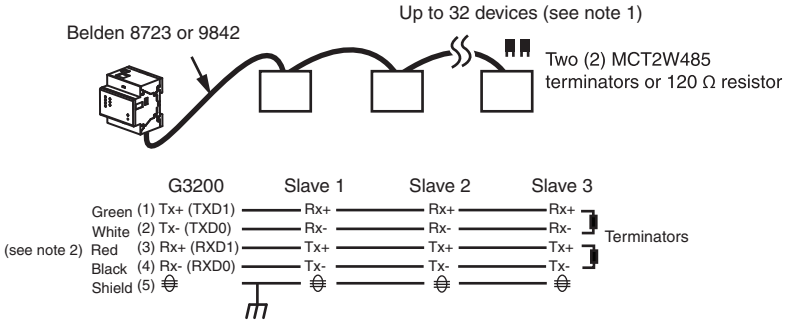
- Connect the power supply and RS 485 twisted pair using cable with cross-section ⩽ 2.5 mm² (⩾AWG 12).
- Connect the 24 VDC power supply to the - and + terminals of the black screw terminal block.
- Connect the RS 485 twisted pair (2-wire or 4-wire) to the (RX+ RX- or RX+ RX- TX+ TX-) terminals of the black screw terminal block.
- Connect the RS 485 twisted pair shielding to the ⏚ terminal of the black screw terminal block.
- Connect the Ethernet cable to the green RJ45 connector.

The G3200 can be connected with a PRI surge arrester for improved surge withstand protection. See Powering the G3200 for surge withstand protection, page 77.

2-wire RS 485 network

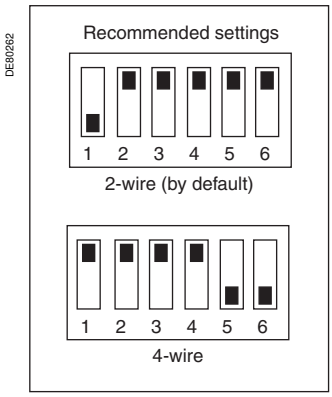


4-wire RS 485 network



Note:
1. The number of daisy chained devices is limited:
- *32 devices is a physical limitation of the RS 485 connection, see Characteristics, page 8.*
- *Application limitations also apply, see Typical architecture, page 5.*

2. In the 4-wire RS 485 network diagram, indicated colors apply to the Belden 8723 cable only. For the Belden 9842 cable, the following color combinations are used: Blue/White (Tx+), White/Blue (Tx-), Orange/White (Rx+) and White/Orange (Rx-).



Setting the RS 485 network parameters.

Setting the RS 485 network parameters

The network polarization and line impedance matching resistors and type of 2-wire/ 4-wire RS 485 network are selected by means of the RS 485 parameter-setting selector switches. These selector switches are configured by default for a 2-wire RS 485 network with network polarization and line impedance matching resistors.

Network line impedance matching with resistor	SW1	SW2	SW3	SW4	SW5	SW6
2-wire RS 485	OFF	ON				
4-wire RS 485	ON	ON				

Network polarization	SW1	SW2	SW3	SW4	SW5	SW6
at the 0 V			ON			
at the 5 V				ON		

Selecting the RS 485 network	SW1	SW2	SW3	SW4	SW5	SW6
2-wire network					ON	ON
4-wire network					OFF	OFF

Ethernet setup

Ethernet setup is required to enable access to the G3200 over a network. If Ethernet setup has already been done at installation time, this section can be skipped and you can proceed directly to the next step. See Accessing the G3200 over a network, page 12.

Before configuring the G3200, obtain a unique static IP address, subnet mask, and default gateway address from your network administrator. Use a web browser or Hyper Terminal to configure the G3200 with the information obtained from your network administrator, as described in the following sections.

Ethernet setup using Hyper Terminal

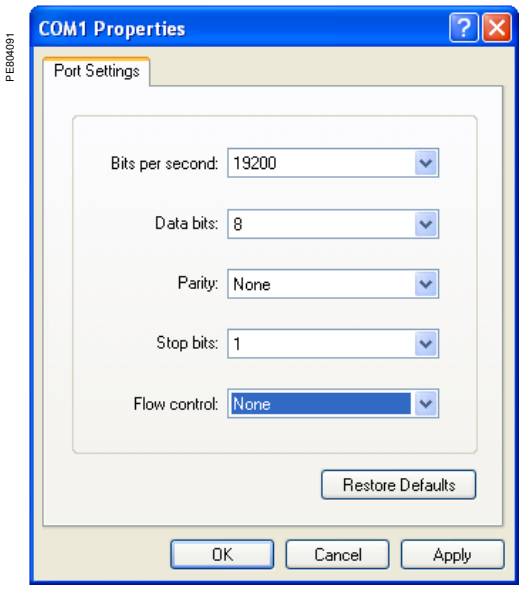
Note: *Windows Vista does not support Hyper Terminal.*

1. Connect to G3200 RS 232 port using the TCSEAK0100 Configuration kit or any null modem cable.
2. Start Hyper Terminal (click **Start** > **Run**, then type `hypertrm`).
3. In the **Name** text box, type a name for the new connection (for example, `G3200 config`), then click **OK**.
4. In the **Connect using** drop-down list, select the computer COM port you will be using, then click **OK**.
5. Set the **COM properties** as follows: Bits per second = 19200, Data bits = 8, Parity = None, Stop bits = 1, and Flow control = None. Click **OK**.
6. Start the G3200 Setup Utility:
   - Cycle power or press the reset button on the G3200 below the LED power status.
   - While the green Power/Status LED blinks rapidly, press Enter on the computer keyboard to access the setup utility.

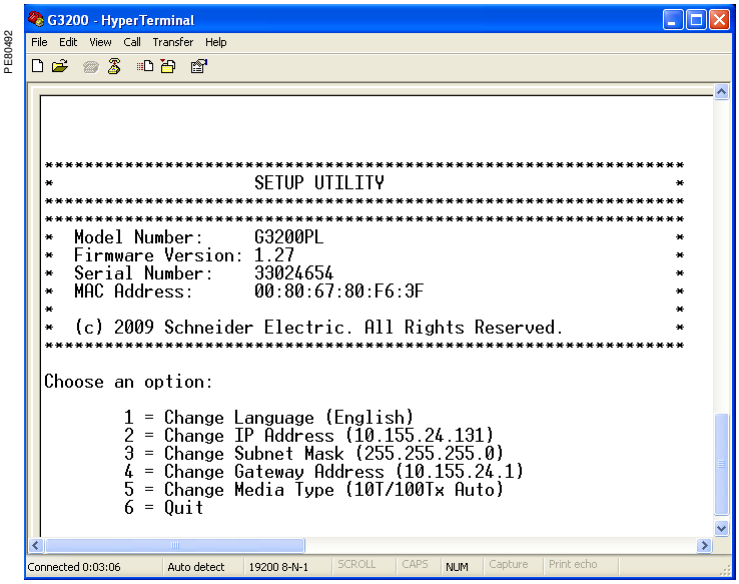
Note: *The Power/Status LED stops blinking after 5 seconds.*

7. The following screen is displayed:

Hyper Terminal: choose connection port.



Hyper Terminal: configure serial port.



Hyper Terminal: access G3200 setup utility.

G3200 setup utility options in Hyper Terminal

Option	Description	Setting
1	Used to select the language for the current Hyper Terminal session.	English, French, Spanish Default: English
2	Used to enter the static IP address of the G3200.	0.0.0.0 to 255.255.255.255 Default: 169.254.0.10
3	Used to enter the subnet mask of your network.	0.0.0.0 to 255.255.255.255 Default: 255.255.0.0
4	Used to enter the default gateway (router) IP address used for wide area network (WAN) communications.	0.0.0.0 to 255.255.255.255 Default: 0.0.0.0
5	Used to define the physical Ethernet connection.	■ 10T/100Tx Auto ■ 10BaseT-HDo 10BaseT-FD ■ 100BaseTx-HD ■ 100BaseTx-FD Default: 10T/100Tx Auto
6	Saves the settings and exits the setup utility.	-

Ethernet setup using a web browser

1. Disconnect your computer from your network.

Note: *After disconnecting from your network, your computer should automatically use the default IP address 169.254.###.### (### = 0 to 255) and the default subnet mask 255.255.0.0. If the IP address is not automatically configured, contact your network administrator to set up a static IP address.*

2. Connect an Ethernet crossover cable (available in the kit TCSEAK0100) from the G3200 to the computer.
3. Start Internet Explorer (version 6.0 or higher).
4. In the Address text box, type `169.254.0.10`, then press Enter. Type `Administrator` for your Username, type `G3200` for your Password, then click **OK**. Usernames and Passwords are case sensitive.
5. Set up parameters. See Ethernet and TCP/IP settings, page 13.
6. Reconnect your computer to your network. If you assigned a static IP address to your computer in step 1, you must restore your computer's original settings before reconnecting to your network.

Handling conflict of IP address between CID file and web page

In case of conflict between the IP address pre-set in the CID file and the IP address set manually in the IP Parameters section of the Ethernet & TCP/IP web page, the IP address in the CID file is taken as the reference unless you configure the G3200 otherwise.

■ If the **Allow CID file to override IP settings** is checked and applied in the Ethernet & TCP/IP web page, the G3200 reboots and the IP parameters of the G3200 are always overwritten by the IP parameters given in the CID file. Successive settings of the IP parameters in the web page reboots the G3200 but with the IP parameters set in the CID file.

■ If the **Allow CID file to override IP settings** option is unchecked (default setting) and applied in the Ethernet & TCP/IP web page, the G3200 reboots with the IP parameters set in the web page.

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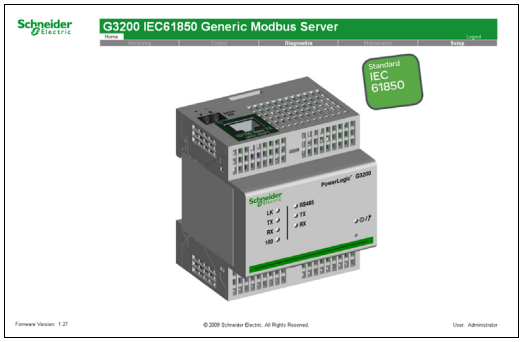


G3200 home page.

Accessing the G3200 over a network

After you have set up the Ethernet parameters, you can access the G3200 over an Ethernet LAN using Internet Explorer 6.0 or higher.

Logging into the G3200

Action	Result
1. Launch Internet Explorer 6.0 or higher.	Opens Internet Explorer.
2. In the Address text box, type the address of your G3200 (`169.254.0.10` is the default), then press Enter.	Opens the Login dialog box.
3. Type your Username (`Administrator` is the default) and Password (`G3200` is the default) into the text boxes, then click **OK**.	Enters the Username and Password, then opens the G3200 home page.
4. Click **Setup** to access the G3200 setup page, or click **Diagnostics** to access the G3200 diagnostics page.	Opens the Setup or Diagnostics pages.

Logging Out

We recommend logging out whenever you do not need access to the G3200. To log out of the G3200 configuration session, click Log Out to end your session.

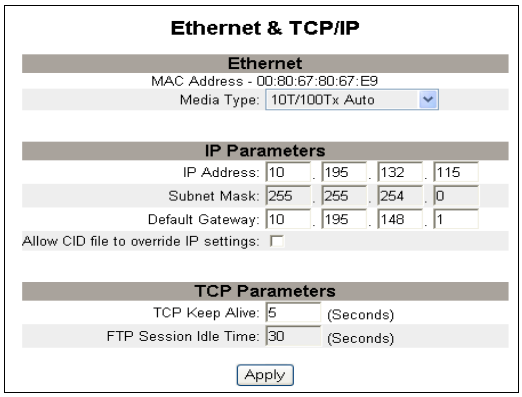
G3200 user interface overview

The G3200 ships with several pre-installed web pages used for G3200 setup, configuration and diagnostics, see table below for a description of each web page. Access to web pages can be restricted, see Access control configuration, page 14.

G3200 web page	Description	See
Setup		
Ethernet & TCP/IP	Configure Ethernet and TCP/IP communication settings.	page 13
Serial Port	Set up or change serial communication parameters.	page 14
TCP/IP Filtering	Set up which IP addresses can access the G3200.	page 15
SNMP Parameters	Enable and configure the Simple Network Management Protocol (SNMP), which allows the G3200 to identify to network devices requesting SNMP data.	page 16
SNTP Parameters	Enable and configure the Simple Network Time Protocol (SNTP), which allows the G3200 to be time synchronized.	page 17
User Accounts (1)	Create and edit groups and users.	page 14
Web Page Access (1)	Select web page access rights for each user group.	page 15
Diagnostics		
Communication statistics	Displays diagnostic data used to troubleshoot network problems.	page 21
G3200 Summary	Contains information about your specific G3200, including the serial number, manufacturing date, Media Access Control (MAC) address, configuration file (CID file) and the Modbus device connectivity.	page 23
Read Device Registers	Allows G3200 administrators to read register data from a serial device connected to the G3200.	page 24

***(1)** Accessible by administrators only.*

PE80046



Ethernet & TCP/IP page.

Communications setup

Ethernet and TCP/IP settings

Procedure

Action	Result
1. From the Setup page, click **Ethernet & TCP/IP**.	Opens the Ethernet & TCP/IP page.
2. Select your media type. Contact your network administrator if you do not know.	Selects the media type.
3. Enter your IP address, subnet mask, and default gateway address assigned to your G3200 by your network administrator.	Enters the Ethernet parameters for the G3200. ***Note:*** *If you enter an IP address that is used by another device, you will be prompted to select a new IP address. See Duplicate IP address detection, page 13.*
4. Click **Apply**.	Updates the G3200 Ethernet and TCP/IP settings.

Note: *After making changes to the Ethernet and IP parameters and clicking Apply, the G3200 will reboot.*

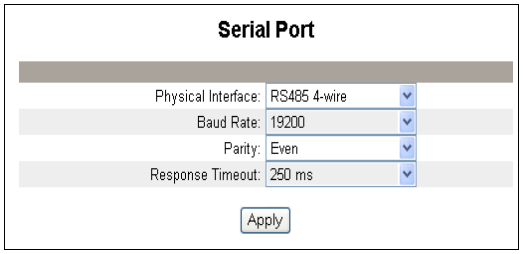
Description of Ethernet and TCP/IP settings

Option	Description	Setting
Media Type	Used to define the physical Ethernet connection or media type.	■ 10T/100Tx Auto ■ 10BaseT-HD ■ 10BaseT-FD ■ 100BaseTX-HD ■ 100BaseTX-FD Default: 10T/100Tx Auto
IP Address	Used to enter the static IP address of the G3200.	0.0.0.0 to 255.255.255.255 Default: 169.254.0.10
Subnet Mask	Used to enter the Ethernet IP subnet mask address of your network.	0.0.0.0 to 255.255.255.255 Default: 255.255.0.0
Default Gateway	Used to enter the gateway (router) IP address used for wide area network (WAN) communications.	0.0.0.0 to 255.255.255.255 Default: 0.0.0.0
Allow CID file to override IP parameters	Check this box if you want the IP parameters contained in the CID file to replace the above configuration.	Default: not checked
Keepalive	Timeout value used to test for session disconnection.	1 to 60 seconds Default: 30 seconds
FTP session inactivity timeout	Timeout value used to force disconnection of an inactive FTP session	30 to 900 seconds Default: 30 seconds

Duplicate IP address detection

While connected to your network, the G3200 publishes its IP address. The IP address of the G3200 must be unique on the network it is connected to. If it is not unique the Power/Status LED repeats a four blink-pause pattern. Assign a new IP address to the G3200 or to the conflicting device.

PE80040



Serial Port page.

Serial port configuration

Procedure

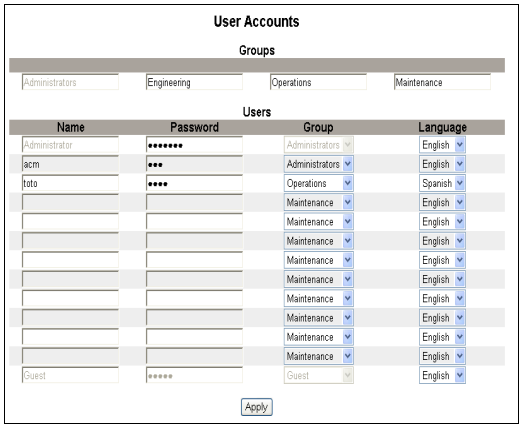
Action	Result
1. From the Setup page, click **Serial Port**.	Opens the Serial Port page.
2. Select your mode, physical interface, transmission mode, baud rate, parity, and response timeout (see table below).	Selects the serial port options.
3. Click **Apply**.	Updates the G3200 Serial Port settings.

Description of serial port settings

Option	Description	Setting
Physical Interface	Used to select how the G3200 serial port is physically wired.	RS 485 4-wire, RS 485 2-wire Default: RS 485 2-wire
Baud Rate	Used to select the data transmission speed over the serial connection.	9600, 19200, 38400 Default: 19200
Parity	Used to select which parity bit is used for checking data.	Even, Odd Default: Even
Response Timeout	Used to select how long the G3200 will wait to receive a response from a device. Default value should usually be kept.	0.1 to 2 seconds Default: 0.4 seconds ***Note:*** *For Power Meter select a minimum value of 0.3 seconds and for Micrologic select a minimum value of 0.4 seconds.*

Note: *The settings defined here must match the settings of the connected Modbus devices.*

PE80056



User Accounts page.

Access control configuration

User accounts

G3200 users are assigned Usernames and Passwords. Each user belongs to a group, and each group has access rights to the G3200 web pages assigned by the G3200 administrator.

Note: *There are two default user accounts: Administrator (password is G3200) and Guest (password is Guest).*

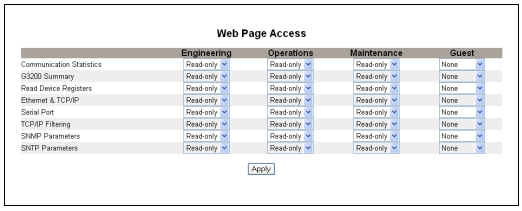
Procedure

Action	Result
1. From the Setup page, click **User Accounts**.	Opens the User Accounts page.
2. If you want to change a group name, type a new name in one of the **Group** text boxes (the Administrator group name cannot be changed).	Enters a new group name.
3. In the **Users** section, enter a Name (1 to 24 characters) and Password (0 to 12 characters) for a new user. ***Note:*** *Usernames and Passwords are case-sensitive and can contain only alphanumeric characters.*	Enters the name and password for a user.
4. Select a group and the default language for the new user.	Selects the group and language for a user.
5. Repeat steps 3 and 4 for each additional user you want to add.	Continues adding users.
6. Click **Apply**.	Saves all of the user account settings.

G3200 accounts and passwords description

Account	Default Password
Administrator (default account)	G3200
Guest (default account)	Guest
User-defined accounts (up to 11 accounts possible)	No default – Password is user-defined

PE80494



Web Page Access page.

Web page access

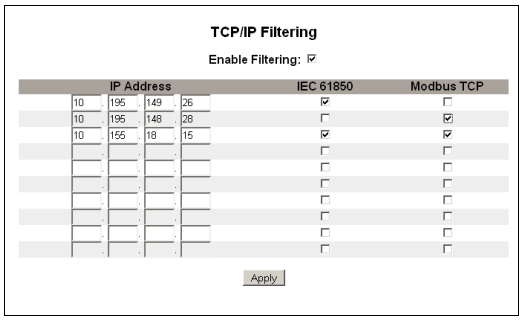
Procedure

Action	Result
1. From the Setup page, click **Web Page Access**.	Opens the Web Page Access page.
2. In the **Ethernet & TCP/IP** row, select the access level (**None**, **Read-only**, or **Full**) that each user group will have for the Ethernet & TCP/IP web page.	See table below for an explanation of access levels for each group.
3. To allow Guest access to the web page, select **Read-only** under the **Guest** column. if the Guest group is Read-only, other groups can only be set to Read-only or Full.	Allows the default Guest group to access the web page.
4. Repeat steps 2 and 3 for the **Serial Port**, **Device List**, **Statistics**, and **Read Device Registers** rows.	Selects the access level for each web page.
5. Click **Apply**.	Saves the password settings.

Group access

Group	Access
Administrator	Full access to all web pages. We recommend that you change the default administrator password for system security the first time you log in.
Guest	Read-only access to selected web pages.
Three user-defined groups	Choosing from the following options, the administrator assigns web page access for each group. Access levels are as follows: ■ None: a group has no access to selected web page ■ Read-only: password grants a group read-only access to the selected web page ■ Full: a group has the same access as the Administrator group to the selected web page

PE80495



TCP/IP Filtering page.

TCP/IP address filtering

This function allows the administrator to specify which IEC 61850 clients and Modbus TCP clients (such as SFT2841, PowerLogic SCADA or Modicon PLC) have access to the G3200 services.

***Note:** If IP addresses filtering is enabled, access is forbidden to any device not in the filtered list.*

Procedure

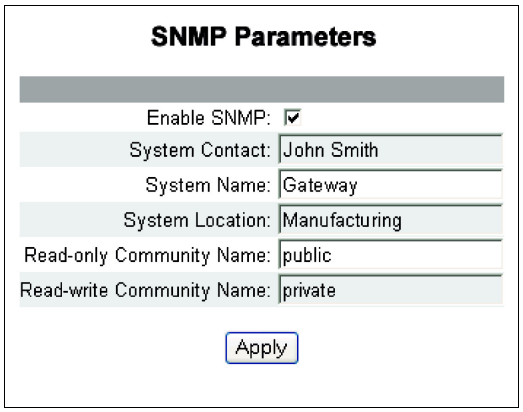
Action	Result
1. From the Setup page, click **IP Address Filtering**.	Opens the **IP Address Filtering** page.
2. Check **Enable Filtering**.	Activates filtering.
3. In the **IP address** column, enter the TCP/IP client address	Enters an IP address for a TCP/IP client that will have access to the IEC 61850 server or to the Modbus TCP link or both.
4. In the **IEC 61850** and **Modbus TCP link** columns, check what applies.	Selects the access level for the corresponding IP address. Modbus TCP link, IEC 61850 or both.
5. Repeat steps 3 and 4 to add more IP addresses.	Continues adding IP addresses for filtering.
6. Click **Apply**.	Saves the IP address filtering list.

G3200 behavior when IP address filtering of IEC 61850 client is activated

If IP filtering is enabled, access is forbidden to any IEC 61850 client not in the filtered list. Any new connections attempted by a client with the restricted IP address will fail and no IEC 61850 data access is possible with the G3200.

The failed connection resulting from IP address filtering is reported at the TCP level as a "response timed out error". To obtain confirmation that the error is related to IP address filtering, log into the web page and check that the IP address is blocked.

PE80055



SNMP Parameters page.

Configuring additional features

SNMP parameters

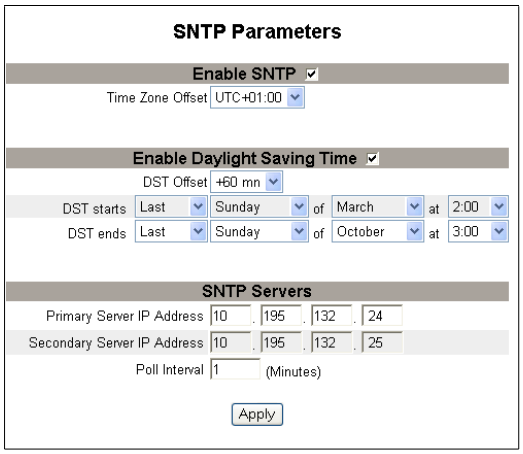
The G3200 supports SNMP, allowing a network administrator to remotely access it with an SNMP manager (such as ConneXview™) and view the networking status and diagnostics in the MIB II format.
The MIB II reading service is the only SNMP service supported by the G3200.

Procedure

Action	Result
1. From the Setup page, click **SNMP Parameters**.	Opens the SNMP Parameters page.
2. Check **ENABLE SNMP** to turn ON the simple network management protocol. ***Note:*** *If you uncheck* ***Enable SNMP*** *and click* ***Apply****, the G3200 will reboot and SNMP functionality will be turned OFF.*	Activates SNMP.
3. Enter the **system contact**, **system name**, **system location**, **read-only community name**, and the **read-write community name**.	Enters the SNMP system information and community access names.
4. Click **Apply**.	Saves the SNMP settings.

Settings description

Option	Description	Setting
Enable SNMP	Checking the check box enables SNMP. MIB II support	**Default**: not enabled
System Contact	Name of the administrative contact.	String (< 50 characters) **Default**: empty string
System Name	Name given to the G3200 and IED subnet.	String (< 50 characters) **Default**: empty string
System Location	Location of the G3200.	String (< 50 characters) **Default**: empty string
Read-only Community Name	SNMP community that has read-only access to the MIB. Acts as a password.	String (< 50 characters) **Default**: "public"
Read-write Community Name	SNMP community that has read-write access to the MIB. Acts as a password.	String (< 50 characters) **Default**: "private"



SNTP Parameters page.

SNTP parameters

SNTP is the time synchronization method required by IEC 61850 to synchronize the internal clock. It is used in mode 3-4 (unicast mode).

The **Enable SNTP** setting forces synchronization between the internal clock of the G3200 and the SNTP server clock. In addition, it forces synchronization between the G3200 clock and the Modbus device's clock.

■ If SNTP is turned OFF, neither the internal clock of the G3200 nor the Modbus devices are synchronized. If effective time stamping is needed, time synchronization must be provided to the Modbus devices by other means (G3200 time is meaningless in this case).

■ If SNTP is turned ON, the G3200 internal clock is synchronized to the SNTP clock server and the G3200 uses the appropriate Modbus request to synchronize the clock of Modbus devices like Sepam, Easergy T200, Micrologic, TeSys T, Circuit Monitor (CM4) and Power Meter (PM8).

***Note:** For Sepam devices, time synchronization must be set up on Sepam to the communication channel linked to G3200.*

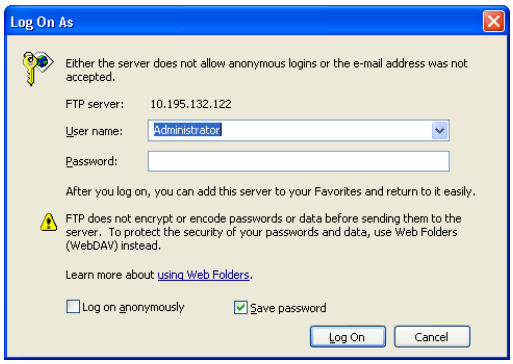
Procedure

Action	Result
1. From the Setup page, click **SNTP Parameters**.	Opens the **SNTP Parameters** page.
2. Check **Enable SNTP** to turn ON the simple network time protocol.	Activates SNTP.
3. Enter the time offset from UTC of your location.	Enters the time zone.
4. Check **Enable DST** to turn ON the Daylight Saving Time (summer Time) feature.	Activates Daylight Saving Time.
5. Enter the time offset for Daylight Saving Time and the start and end time.	Enters DST time offset: start time and end time.
6. Enter the IP address of the primary (or only) SNTP server. If available, enter the IP address of a secondary server to be used if the primary one is not responding.	Enters the address of the SNTP server(s).
7. Enter the poll interval between two requests to the server.	Enters poll interval
8. Click **Apply**.	Saves the SNTP settings.

Setting descriptions

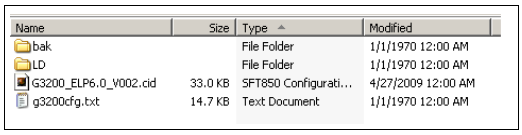
Option	Description	Setting
Enable SNTP	Enables the time and date of the G3200 to be set by the Simple Network Time Protocol (SNTP) server.	**Default**: not enabled
Time Zone Offset	Determines the difference between local time and Coordinated Universal Time (UTC) (same as GMT).	UTC-12 to UTC+13 **Default**: UTC
Enable Daylight Saving Time	Enables the use of Daylight Saving Time (Summer time).	**Default**: not enabled
DST offset	Difference between standard time and Daylight Saving Time.	+ 30 or + 60 minutes **Default**: none
DST starts	If enabled, DST starts on the selected date.	**Default**: none
DST ends	If enabled, DST ends on the selected date.	**Default**: none
Primary Server IP Address	The IP address of the SNTP server the G3200 contacts for the time message.	0.0.0.0 to 255.255.255.255 **Default**: 0.0.0.0
Secondary Server IP Address	The IP address of another SNTP server the G3200 contacts in case the primary server is down.	0.0.0.0 to 255.255.255.255 **Default**: 0.0.0.0
Poll Interval	Controls how often the G3200 contacts the SNTP server for the correct time.	10 minutes to 1 day **Default**: 1 hour.

PE80106



Logging into the FTP server.

PE80496



G3200 directories view.

Accessing the G3200 FTP server

After you have set up the Ethernet parameters, you can access the G3200 FTP server, using Internet Explorer or another FTP client. The following description is made using Internet Explorer 6. Mozilla Firefox and Internet Explorer 7 or higher cannot be used.

Note: *Access to the FTP server is restricted to accounts belonging to the Administrators group.*

Logging into the FTP server

Action	Result
1. Launch Internet Explorer, type `ftp://` and the IP address of the G3200 in the Address text box (for example, `ftp://10.10.10.10`), then press **Enter**.	Opens the **Log On As** dialog box.
2. Type the Username and the Password in the text boxes as previously defined. Default Username is "Administrator" and default Password is "G3200". Then click **Log On**. See Access control configuration, page 14.	Opens an FTP session with the G3200 and displays the root directory of the G3200.

G3200 directories

Root directory

The root directory contains:

- the logical devices directory LD

It is structured as described by the IEC 61850 standard. There is one directory for each Modbus Logical Device, i.e for each Modbus serial device.

- the backup directory BAK

It contains the backup IEC 61850 file, if any. This file can only be read. This file is only kept as an archive. It is not used by the G3200.

- the G3200 standard configuration file "g3200cfg.txt". This file can be read or written. It is checksum protected and must not be modified. When written to the device, it updates the device parameters except the Ethernet settings.
- the IEC 61850 configuration file CID (if loaded). This file can be read or written. It is protected and can be modified only with SFT850 or an appropriate XML editor. See Building a CID file from an ICD file, page 48.

Transferring files from the G3200 to the computer

Action	Result
1. Right-click the file you want to download from the G3200, then click **Copy**.	Copies the selected file.
2. Locate the folder you want to save the copied file, right-click in the folder's window, then click **Paste**.	Pastes the file into the folder.
3. Repeat steps 1 and 2 if you want to copy other files from the G3200	Continues to copy files from the G3200.
4. Click the **Close** button on the Internet Explorer window.	Closes Internet Explorer and ends the FTP connection to the G3200.

Transferring files from the computer to the G3200

Writable files are transferred to the G3200 as described above, inverting source and destination folders.

The build of the CID file can be performed off-line.
See Creating a CID file, page 44.

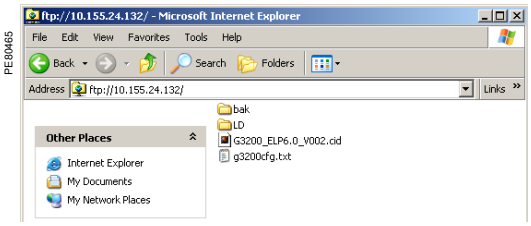
Transferring a CID file

A CID file contains all the IEC 61850 configuration information required for any generic Modbus device or a G3200.

Two methods are available to transfer the CID file from the FTP server into the G3200:

- copy using Windows browser
- transfer using Windows command prompt tool.

Note: *The command prompt tool is the fastest method of transferring the CID file into the G3200.*



Transferring CID file using Windows browser.

Transferring a CID file using Windows browser

To transfer the CID file using Windows browser, proceed as follows:

1. Launch Windows Internet Explorer 6.0 or lower.

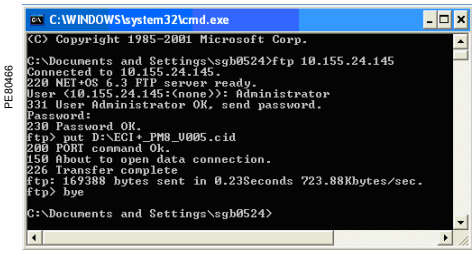
Note: *Mozilla Firefox and Internet Explorer 7.0 or higher cannot be used.*

2. In the **Address** text box, connect to the FTP server by typing the IP address of your G3200, and then press **Enter**.
3. Type your **Username** (`Administrator` is the default) and **Password** (`G3200` is the default) into the text boxes, and then click **OK**.

Note: *Username and password are case-sensitive.*

The CID file is copied at the root of the file system: `ftp://<ip address>/`.

A back-up copy of the previous CID file is automatically created in the directory `ftp://<ip address>/bak`. It is possible to revert to the previous configuration by restoring the back-up file in the G3200 Summary web page. See G3200 Summary, page 23.



Transferring CID file using Windows command prompt.

Transferring a CID file using Windows command prompt tool

To transfer the CID file using Windows command prompt tool, proceed as follows:

1. Start the command prompt tool by clicking **Start > Run**, and then type command in the **Open** text box.
2. In the command prompt window, connect to the FTP server by typing the IP address of your G3200:
   `C:\.....> ftp <IP address>`
3. Enter the username by typing:
   `User <IP Address>:<none>>: Administrator`
4. When the user identity is verified, you are prompted to enter a password. Type
   `Password:G3200`
5. When the password is verified, enter the path for the CID file to be loaded. Type
   `ftp> put <full path of CID file>`
6. The `Transfer complete` message indicates that the transfer has been successful and you are automatically logged off from the FTP server.

After the CID file has been correctly loaded, an automatic restart is performed and then the G3200 runs with the new settings included in the new CID file.

CID file content checking and diagnostics

If the CID file is not valid, it is rejected by the G3200 during the FTP session. To obtain the cause and how to solve the error, log into the advanced diagnostic web page of the G3200 and view the last log entry listed at the following address:
`http://<<G3200 IP Address>>/InfoLog.htm`

The table below lists the most common error messages encountered, their possible cause and suggested way to resolve them.

Error message	Possible cause of error	Suggested solution
CID file download failed - Wrong MD2 key	The CID file contents have been modified manually but the MD2 key has not been updated.	Open the file with SFT850 and re-generate the MD2 key. To do so, make some changes to the file, undo them and save the file in SFT850. This action generates the latest MD2 key in the file.
CID file download failed - File too big	The size of the CID file is over 1MB.	Reduce the size of the CID file to under 1MB.
CID file download failed - File not intended for G3200	A CID file that does not belong to G3200 has been loaded.	Ensure that the tag "SchneiderElectric-IED-Type" always has the value "G3200".
CID file download failed - Unable to write into flash memory	The memory in the G3200 is corrupt.	Retry the operation before contacting the sales team.
CID file download failed - Not an SCL file	A file other than a SCL file has been loaded into the G3200.	Ensure that the file being loaded is a SCL file.
CID file download failed - File already exists in G3200	The file being downloaded is already the "current CID file" in the G3200.	No action required.

Modbus device connection checking

As soon as the G3200 is powered-on and its CID file checked, the G3200 attempts to connect to each Modbus device and verify its type. This test is performed periodically so that any change in the RS 485 link is detected immediately. The check performed and results obtained depend on whether the device model is set in the CID file.

Check behavior of G3200 if device model is set in CID file

If the device model is set in the CID file, i.e.,the "device model" `series` string of the considered Logical Device is not set to "UNK", the G3200 attempts to retrieve the ID from the Modbus device and compare it to the `configuration` field content defined in the corresponding Logical Device in the CID file. See Defining Device Model strings, page 50.

If the result of the comparison is satisfactory (both the expected and the actual result derived from the retrieved values are the same):
- the corresponding Logical Device status is made **Online** in the Summary web page,
- the G3200 becomes fully operational from an IEC 61850 client for this logical device.

If the result of this comparison is negative (the expected and the actual result derived from the retrieved values are different), the G3200 assumes that an incorrect device is connected with the same Modbus address as specified in the CID file:
- the Logical Device status in the Summary web page is displayed as **Wrong type**,
- LLN0$Mod and LLN0$Beh of the considered Logical Device indicate "bad connectivity" of the device,
- IEC 61850 data attached to the corresponding Logical Device keeps its previous value and time-stamp.

If there is no response after three consecutive identification queries from the G3200:
- the corresponding Logical Device status is displayed as **Offline** in the Summary web page,
- LLN0$Mod and LLN0$Beh of the considered Logical Device indicate "bad connectivity" of the device,
- IEC 61850 data attached to the corresponding Logical Device keeps its previous value and time-stamp.

The lack of response to the identification queries can be a result of:
- broken Modbus connectivity between the G3200 and the connected device,
- incorrect RS-485 serial configuration,
- the Modbus address of the device is different from the one configured.

Check behavior of G3200 if device model is "unknown" in CID file

If the device model is "unknown" in the CID file, i.e. the "device model" `series` string of the considered LD is set to "UNK", no device type checking is performed. The G3200 assumes that the device type is not described and not checkable.

The G3200 does perform link connectivity checking periodically by sending the Modbus table read requests with the Modbus address given in the CID file.

If the G3200 is able to receive the data for at least one of the tables:
- the device is made **Online**,
- the G3200 becomes fully operational from an IEC 61850 client for this logical device.

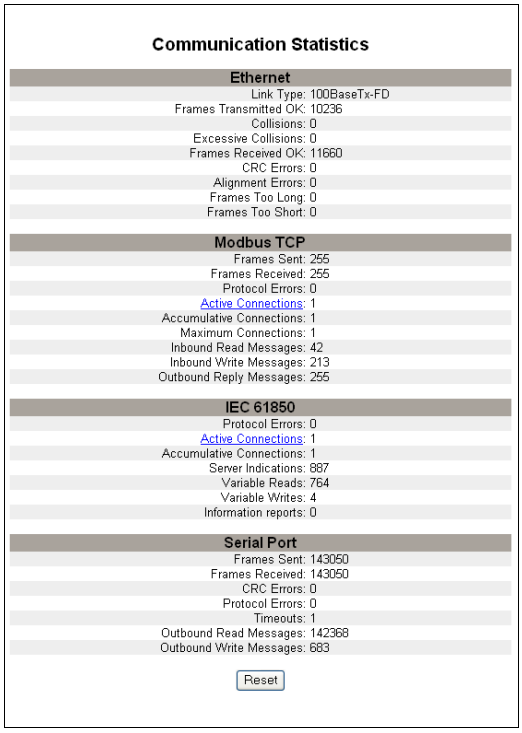
If the G3200 is not able to receive the data for at least one of the Modbus tables:
- the Logical Device status in the Summary web page is displayed as **Offline**,
- LLN0$Mod and LLN0$Beh of the considered Logical Device indicate "bad connectivity" of the device,
- IEC 61850 data attached to the corresponding Logical Device keep its previous value and time-stamp.

Introduction

Diagnostics web pages provide useful information for network monitoring, tuning, and troubleshooting.
There are 3 diagnostics web pages:

- Communication statistics web page to troubleshoot Ethernet TCP/IP communication
- G3200 summary web page to display communication identification parameters
- Read device registers web page to troubleshoot Modbus communication

PE80497



Communication Statistics page.

Communication statistics

Procedure

Action	Result
1. From the **Diagnostics** page, click **Communication Statistics**.	Opens the **Communication Statistics** page.
2. View the data.	See Interpreting statistics, page 21.
3. Click **Reset**.	Resets the G3200 cumulative diagnostic data to 0.

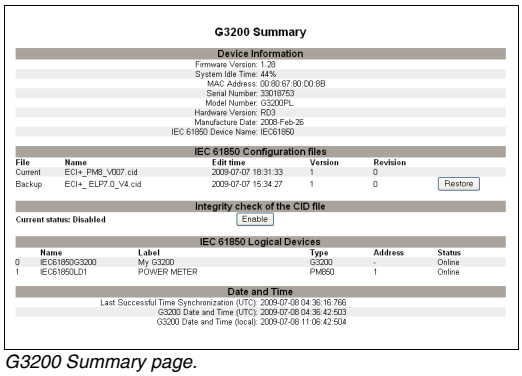
Interpreting statistics

Statistic	Description
Ethernet	
Link Status	A status string that represents the speed and duplex setting being used to communicate with the linking partner.
Frames Transmitted OK	A counter that increments each time a frame is successfully transmitted.
Collisions	A counter that increments each time a frame is retransmitted due to collision detection.
Excessive Collisions	A counter that increments each time a frame is not able to be sent due to reaching the maximum collision status based on the Truncated Binary Exponential Backoff algorithm.
Frames Received OK	A counter that increments each time a frame is successfully received.
CRC Errors	A counter that increments each time a frame is received that has a checksum/CRC that does not match what is calculated.
Alignment Errors	A counter that increments each time a frame is received that has a checksum/CRC error and does not end on an 8-bit frame boundary.
Frames Too Long	A counter that increments each time a frame is received that is larger than the allowed maximum size defined in the standards (frames larger than 1518 bytes).
Frames Too Short	A counter that increments each time a frame is received that is smaller than the allowed minimum size defined in the standards (frames smaller than 64 bytes).
Modbus TCP	
Frames Sent	A counter that increments each time a frame is sent.
Frames Received	A counter that increments each time a frame is received.
Protocol Errors	A counter that increments each time an ill-formed message is received.
Active Connections	A status value that represents the number of connections that are active at the moment the diagnostics web page is refreshed. A maximum of 4 connections are supported. Clicking Active Connections opens a new window with a list of all of the active client connections.
Accumulative Connections	A counter that increments each time a connection is made to the G3200.
Maximum Connections	A status value that represents the maximum number of connections that were active at any given moment.
Inbound Read Messages	A counter that increments each time a read request message is received.
Inbound Write Messages	A counter that increments each time a write request message is received.
Outbound Reply Messages	A counter that increments each time a reply message is sent.

Interpreting statistics (cont.)

Statistic	Description
IEC 61850	
Protocol Errors	A counter that increments each time a received request is incorrect or cannot be satisfied.
Active Connections	A status value that represents the number of connections that are active at the moment the diagnostics web page is refreshed. A maximum of 6 connections are supported. Clicking Active Connections opens a new window with a list of all of the active client connections.
Accumulative Connections	A counter that increments each time a connection is made to the G3200.
Server indications	A counter that increments each time the server receives a protocol indication.
Variable Reads	A counter that increments each time the server receives a read variable request.
Variable Writes	A counter that increments each time the server receives a write variable request.
Information reports	A counter that increments each time the server sends an information report message.
Serial port	
Frames Sent	A counter that increments each time a frame is sent.
Frames Received	A counter that increments each time a frame is received.
CRC Errors	A counter that increments each time a message is received that has a CRC that does not match what is calculated. Typically the result of wiring issues.
Protocol Errors	A counter that increments each time an ill-formed message is received.
Timeouts	A counter that increments each time a request message is sent without receiving a corresponding response message within the allowed time. Timeouts are typically the result of configuration errors or a non-responsive device.
Outbound Read Messages	A counter that increments each time a read request message is sent.
Outbound Write Messages	A counter that increments each time a write request message is sent.

PE80498



G3200 Summary page.

G3200 Summary

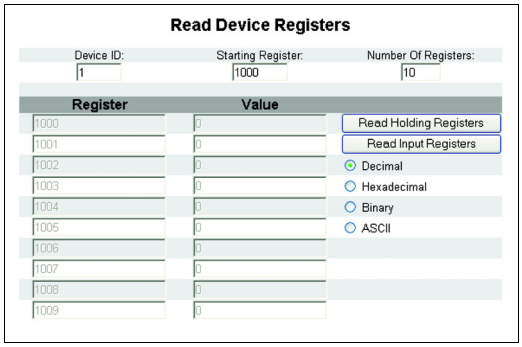
Procedure

Action	Result
1. From the **Diagnostics** page, click **G3200 Summary**.	Opens the **G3200 Summary** page.
2. View the data.	See Interpreting information, page 23.

Interpreting information

Information	Description
Device Information	
Firmware Version	The firmware version that is installed on the G3200
System Idle Time	A percentage from 0% to 100% indicating the average processor time that is not being used
MAC Address	The unique Ethernet hardware address of the G3200
Serial Number	The serial number of the G3200
Model Number	The G3200 model number
Hardware Version	The G3200 hardware version
Manufacture Date	The date the G3200 was manufactured
IEC 61850 Device Name	The name given to the G3200 device in the IEC 61850 configuration file
IEC 61850 Configuration files	
File	"*Current*" is the last loaded CID file "*Backup*" is the archived CID file
Name	Name of the file as defined at loading
Edit time	Time at which the configuration file has been created
Version	Version of the file as defined in the file header
Revision	Revision of the file as defined in the file header
Restore	This button overwrites the content of the current file with the content of the backup file.
Integrity check of the CID file	
Current status: Enabled	The MD2 key evaluation of the CID file is enabled during the FTP session. To disable this, click the button Disable
Current status: Disabled	The MD2 key evaluation of the CID file is disabled during the FTP session. To enable this, click the button Enable
IEC 61850 Logical devices	
Name	Name of the logical device built from the configuration file
Label	Label of the device (Modbus device label or G3200 system name)
Type	Type of the device as declared in the configuration file
Address	Modbus address of the device as declared in the configuration file
Status	■ Offline: the declared device does not respond to G3200 requests ■ Wrong type: the device at this address is not of the expected type ■ Init: the device database is being initialized ■ Online: the device is operational ■ Bad Conf.: there is an error in the configuration file, the device is ignored See Defining Device Model strings, page 50.
Date and time	
Last Successful Time Synchronization (UTC)	Displays the last time the G3200 successfully contacted the SNTP server (UTC time).
G3200 Date and Time (UTC)	Current time and date of the G3200 (UTC time).
G3200 Date and Time (local)	Current time and date of the G3200 (local time).

PE80054



Read Device Registers page.

Read Device Registers

Read Device Registers web page can be used to check Modbus communication between the G3200 and Modbus devices.

Procedure

Action	Result
1. From the Diagnostics page, click **Read Device Registers**.	Opens the Read Device Registers page.
2. Enter the **Device ID**, **Starting Register** number, and the **Number of Registers** to read.	Enters the values to begin reading registers for the specified device.
3. Click **Read Holding Registers** or **Read Input Registers**.	Displays the values for the listed registers.
4. To change how the data is displayed in the **Value** column, select **Decimal**, **Hexadecimal**, **Binary**, or **ASCII**.	Selects how the data values are displayed.

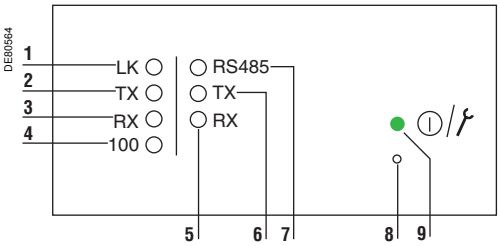
G3200 Read Device Register Settings

Option	Description	Default
Device ID	The address of the device that registers are read.	1
Starting Register	The first register to read.	1000
Number of Registers	The number of registers to read (1 to 10).	10
Register column	Lists the register numbers.	-
Value column	Lists the data stored in a register.	-
Decimal, Hexadecimal, Binary, or ASCII options	Select an option to specify how the Value column data is displayed.	Decimal

Troubleshooting makes use of:
- G3200 front panel LED indicators
- G3200 diagnostics web pages

Troubleshooting should be done in the following order:
1. Check the G3200 connection to Ethernet.
2. Check the Modbus subnetwork.
3. Check the IEC 61850 configuration.

G3200 front panel LED indicators



Ethernet LEDs:

1 LK green LED on: network link active

2 Flashing green Tx LED: G3200 transmission active

3 Flashing green Rx LED: G3200 reception active

4 100 green LED
- On: 100 Mbps network speed
- Off: 10 Mbps network speed

Standard LEDs:

5 Flashing green Rx LED: G3200 reception active

6 Flashing green Tx LED: G3200 transmission active

7 RS 485 LED: network link active:
- On: RS 485 mode
- Off: RS 232 mode

8 Reset button

9 Power-up/maintenance LED

G3200 and Ethernet troubleshooting

Symptoms	Possible cause	Action/Remedy
Power/Status LED off	Source power is not applied or is not stable.	Apply power or check source.
	LED is burned out.	Check to see if other LEDs operate properly.
Ethernet LK LED off	Proper link is not established.	1. Make sure the proper cable is used and connected. 2. Make sure the proper media type is selected in the G3200. 3. Check the communications setup configuration.
Power/Status LED repeats a four blink-pause pattern.	The IP address that the G3200 was assigned is being used by another network device.	Assign a new IP address to the G3200 or to the conflicting device. ***Note:*** *When a duplicate IP address is detected, the G3200 resets its specified IP address to the default IP address. When the G3200 detects the conflict no longer exists, it will use the specified IP address.*
Cannot browse the G3200.	Incorrect network configuration.	1. Verify all IP parameters are correct. 2. Verify G3200 receives requests: ping G3200 by: ■ going to DOS prompt ■ typing `ping` and the G3200 IP address ■ e.g., `ping 169.254.0.10`. 3. Verify that all browser Internet connections settings are correct.

Modbus subnetwork troubleshooting

Symptoms	Possible cause	Action/Remedy
RS 485 LED off	G3200 has not started correctly.	Check to see if there is an Ethernet connection problem.
Serial TX not flashing	The IEC 61850 server is not configured and there is no Modbus TCP remote connection active.	This is a normal situation.
	The IEC 61850 server is not configured and there a Modbus TCP remote connection active.	The Modbus TCP connection can be active on another G3200. Check IP addresses.
	The IEC 61850 server is configured and there is no SFT2841 remote connection active.	Check the IEC configuration file.
Serial TX flashing Serial RX not flashing	Setting of G3200 serial port does not match setting of Modbus devices.	Check and correct settings.
	Modbus addresses configured in the IEC file or in the Modbus TCP do no match device addresses.	Check and correct addresses.
	The RS 485 network is not wired properly.	Check and correct wiring.

IEC 61850 configuration troubleshooting

Symptoms	Possible cause	Action/Remedy
IEC 61850 clients cannot connect to the G3200	Ethernet setup is not correct.	See Ethernet setup, page 10.
	The maximum number of active connections is reached.	Check the active clients.
	The IP address of the client is filtered out.	See TCP/IP address filtering, page 15.
IEC 61850 clients connect to the G3200, but no data is available	The IEC 61850 server is not configured or the configuration file is not valid.	Download a valid configuration file.
The IEC 61850 server is working, but some logical devices do not report data.	The actual Modbus device type at a given address is not the type expected in the configuration file.	Check device address, correct the configuration file or replace device.
	The device is not communicating.	Check device, check its communication parameters, check wiring.
Status in the web page displays **offline**	1. Modbus address is different. 2. Selected Baud rates in the G3200 and in the device are different. 3. DIP switch for RS 485 2-wire or 4-wire settings are in wrong position.	Check for the 3 possible errors listed and correct the settings.
Status in the web page displays **Wrong Type**	A device of different type is connected.	Connect the device specified in the CID file. Check that the content "device model" field included in the loaded CID files corresponds to the connected device. See Defining Device Model strings, page 50.
Status in the web page displays **Bad conf.**	Device model string in the CID file is empty.	Complete the appropriate `series` and `configuration` strings. See Defining Device Model strings, page 50.

CID file troubleshooting

Error messages may appear during the donwnload of the CID file to the G3200.
See CID file content checking and diagnostics, page 19.

Capabilities description

General

This chapter describes the level of conformity of the G3200 with IEC 61850. It does not describe the standard itself, but only the choices that have been made in the G3200 implementation of the standard, in terms of services, modelling, exceptions, extensions and adaptations

The capabilities description consists of the following documents:

- ACSI conformance statement: this document describes the abstract services interface (which services are implemented). These services are mapped to Specific Communication Services Mapping (SCSM) described in the PICS.
- MICS (Model Implementation Conformance Statement): describes how the information model is implemented.
- PICS (Protocol Implementation Conformance Statement): describes choices made in protocol implementation. Many of these choices are implied by the ACSI conformance statement.
- PIXIT (Protocol Implementation eXtra Information for Testing): gives any additional implementation specific information not found in the previous standardized documents. This information can be useful for operation of the devices.

ACSI
*The **A**bstract **C**ommunication **S**ervices **I**nterface is defined by part 7-2 of IEC 61850.*
It provides:
- *the specification of a basic information model,*
- *the specification of information exchange service models.*

These conformance statement tables are as defined by Annex A of IEC 61850-7-2.

ACSI basic conformance statement

		Client / subscriber	Server / publisher	Value / comments
Client-server roles				
B11	**Server** side (of TWO-PARTY APPLICATION-ASSOCIATION)		■	
B12	**Client** side of (TWO-PARTY APPLICATION-ASSOCIATION)			
SCSMs supported				
B21	**SCSM**: IEC 61850-8-1 used		■	
B22	**SCSM**: IEC 61850-9-1 used			
B23	**SCSM**: IEC 61850-9-2 used			
B24	**SCSM**: other			
Transmission of sampled value model (SVC)				
B41	**Publisher** side			
B42	**Subscriber** side			

ACSI service conformance statement

Services		AA: TP/MC	Client / subscriber	Server / publisher	Value / comments
Server (Clause 6)					
S1	ServerDirectory	TP		■	
Application association (Clause 7)					
S2	Associate			■	
S3	Abort			■	
S4	Release			■	
Logical device (Clause 8)					
S5	LogicalDeviceDirectory	TP		■	
Logical node (Clause 9)					
S6	LogicalNodeDirectory	TP		■	
S7	GetAllDataValues	TP		■	
Data (Clause 10)					
S8	GetDataValues	TP		■	
S9	SetDataValues	TP			
S10	GetDataDirectory	TP		■	
S11	GetDataDefinition	TP		■	
Data set (Clause 11)					
S12	GetDataSetValues	TP		■	
S13	SetDataSetValues	TP			
S14	CreateDataSet	TP			
S15	DeleteDataSet	TP			
S16	GetDataSetDirectory	TP		■	
Substitution (Clause 12)					
S17	SetDataValues	TP			
Setting group control (Clause 13)					
S18	SelectActiveSG	TP		■	
S19	SelectEditSG	TP			
S20	SetSGValues	TP			
S21	ConfirmEditSGValues	TP			
S22	GetSGValues	TP			
S23	GetSGCBValues	TP		■	

Note:
AA: Application Association
TP: Two Party
MC: Multi Cast
■: *supported*

ACSI service conformance statement (cont.)

Services		AA: TP/MC	Client / subscriber	Server / publisher	Value / comments
Reporting (Clause 14)					
Buffered Report Control Block (BRCB)					
S24	Report	TP		■	
S24-1	data-change (dchg)			■	
S24-2	quality-change (dchg)			■	
S24-3	data-update (dupd)			■	
S25	GetBRCBValues	TP		■	
S26	SetBRCBValues	TP		■	
Unbuffered Report Control Block (URCB)					
S27	Report	TP			
S27-1	data-change (dchg)				
S27-2	quality-change (qchg)				
S27-3	data-update (dupd)				
S28	GetURCBValues	TP			
S29	SetURCBValues	TP			
Logging (Clause 14)					
Log Control Block					
S30	GetLCBValues	TP			
S31	SetLCBValues	TP			
Log					
S32	QueryLogByTime	TP			
S33	QueryLogAfter	TP			
S34	GetLogStatusValues	TP			
Generic substation event model (GSE) (Clause 15)					
GSSE Control Block					
S40	SendGSSEMessage	MC			
S41	GetReference	TP			
S42	GetGSSEElementNumber	TP			
S43	GetGsCBValues	TP			
S44	SetGsCBValues	TP			
Transmission of sampled values model (SVC) (Clause 16)					
Multicast SVC					
S45	SendMSVMessage	MC			
S46	GetMSVCBValues	TP			
S47	SetMSVCBValues	TP			
Unicast SVC					
S48	SendUSVMessage	TP			
S49	GetUSVCBValues	TP			
S50	SetUSVCBValues	TP			
Control (Clause 17)					
S51	Select	TP			
S52	SelectWithValue	TP		■	
S53	Cancel	TP		■	
S54	Operate	TP		■	
S55	CommandTermination	TP		■	
S56	TimeActivatedOperate	TP			
File transfer (Clause 20)					
S57	GetFile	TP		■	
S58	SetFile	TP			
S59	DeleteFile	TP			
S60	GetFileAttributeValues	TP		■	
Time (Clause 18)					
T1	clock resolution of internal clock (nearest value of 2^{-n} in seconds)			n = 10 (T1)	
T2	Time accuracy of internal clock				
T3	Supported TimeStamp resolution (nearest value of 2^{-n} in seconds)			n = 10 (T1)	

Note:
AA: Application Association
TP: Two Party
MC: Multi Cast
■: *supported*

ACSI model conformance statement

		Client / subscriber	Server / publisher	Value / comments
If server side (B11) supported				
M1	Logical device		■	
M2	Logical node		■	
M3	Data		■	
M4	Data set		■	
M5	Substitution			
M6	Setting group control		■	Active SG only
M7	Buffered report control		■	
M7-1	sequence-number		■	
M7-2	report- time-stamp		■	
M7-3	reason-for-inclusion		■	
M7-4	data-set-name		■	
M7-5	data-reference		■	
M7-6	buffer-overflow		■	
M7-7	EntryId		■	
M7-8	BufTm		■	
M7-9	IntgPd		■	
M7-10	GI		■	
M8	Unbuffered report control			
M8-1	sequence-number			
M8-2	report- time-stamp			
M8-3	reason-for-inclusion			
M8-4	data-set-name			
M8-5	data-reference			
M8-6	BufTm			
M8-7	IntgPd			
M8-8	GI			
M9	Log Control			
M9-1	IntgPd			
M10	Log			
M11	Control		■	
If GSE (B31/B32) supported				
M12	GOOSE			
M12-1	entryID			
M12-2	DataRefinc			
M13	GSSE			
If SVC (B41/B42) supported				
M14	Multicast SVC			
M15	Unicast SVC			
Other				
M16	Time		■	
M17	File Transfer		■	

Note:
■: *supported*

Capabilities description
MICS - Model implementation conformance statement

The information model is defined by parts 7-3 and 7-4 of IEC 61850.
It provides:
■ *the specification of the Logical Nodes used to model substation devices and functions,*
■ *the specification of Common Data Classes and Common Data Attribute Classes used in the Logical Nodes.*

Model conformance

The Model conformance of each particular Modbus device is described by its ICD file. The following descriptions are general descriptions that apply to all Modbus devices.

Common data attributes classes

The following tables list which fields is found in each Common Data Attribute Class (CDAC). Fields not found in these tables are optional (O) or conditional (C) fields not supported by Modbus devices. Mandatory fields (M) are always present.

Quality

Attribute name	Attribute type	Value/Value range	M/O/C	Comments
validity	CODED ENUM	good | invalid	M	Supported
detailQual	PACKED LIST		M	Supported
overflow	BOOLEAN	DEFAULT : FALSE	M	Defaulted
outOfRange	BOOLEAN	TRUE | FALSE	M	Supported
badReference	BOOLEAN	TRUE | FALSE	M	Supported
oscillatory	BOOLEAN	DEFAULT : FALSE	M	Defaulted
failure	BOOLEAN	TRUE | FALSE	M	Supported
oldData	BOOLEAN	DEFAULT : FALSE	M	Defaulted
inconsistent	BOOLEAN	TRUE | FALSE	M	Supported
inaccurate	BOOLEAN	TRUE | FALSE	M	Supported
source	CODED ENUM	process | substituted DEFAULT : process	M	Defaulted
test	BOOLEAN	DEFAULT : FALSE	M	Defaulted
operatorBlocked	BOOLEAN	DEFAULT : FALSE	M	Defaulted

Analogue value

Attribute name	Attribute type	Value/Value range	M/O/C
f	FLOAT32	floating point value	C

Configuration of analogue value

Common data attribute class not supported.

Range configuration

Common data attribute class not supported.

Step position with transient indication

Common data attribute class not supported.

Pulse configuration

Common data attribute class not supported.

Originator

Attribute name	Attribute type	Value/Value range	M/O/C
orCat	ENUMERATED	See IEC 61850-7-3	M
orIdent	OCTET STRING64		M

Unit definition

Common data attribute class not supported.

CtxInt

Context specific integer. The type depends on the data object.
For Mod, Beh, Health, PhyHealth, EEHealth and AutoRecSt data objects, the type is ENUMERATED, otherwise, the type is INT32.

Note:
M: mandatory field
O: optional field
C: conditional field

Vector definition

Attribute name	Attribute type	Value/Value range	M/O/C
mag	AnalogueValue		M
ang	AnalogueValue		O

Point definition

Common data attribute class not supported.

CtlModels definition

Attribute value	Comment
status-only	not controllable SPC, DPC and INC
direct-with-normal-security	controllable SPC and INC
direct-with-enhanced-security	not supported
sbo-with-normal-security	not supported
sbo-with-enhanced-security	controllable DPC

SboClasses definition

Attribute value	Comment
operate-once	
operate-many	not supported

Common data classes

The following tables list which attributes is found in each Common Data Class (CDC). Attributes not found in these tables are optional (O) or conditional (C) attributes not supported by the corresponding Modbus devices. Mandatory attributes (M) are always present.

Single point status (SPS)

Attribute name	Attribute type	FC	M/O/C	Comments
stVal	BOOLEAN	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
dataNs	VISIBLE STRING255	EX	C	for non standard data objects

Double point status (DPS)

Common data class not supported.

Integer status (INS)

Attribute name	Attribute type	FC	M/O/C	Comments
stVal	CtxInt	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
dataNs	VISIBLE STRING255	EX	C	for non standard data objects

Protection activation information (ACT)

Attribute name	Attribute type	FC	M/O/C	Comments
general	BOOLEAN	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	

Directional protection activation information (ACD)

Attribute name	Attribute type	FC	M/O/C	Comments
general	BOOLEAN	ST	M	
dirGeneral	ENUMERATED	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	

Note:
M: mandatory field
O: optional field
C: conditional field

Security violation counting (SEC)

Common data class not supported.

Binary counter reading (BCR)

Attribute name	Attribute type	FC	M/O/C	Comments
actVal	INT128	ST	M	(1)
actVal	INT32	ST	M	(1)
q	Quality	ST	M	
t	TimeStamp	ST	M	
units	Unit	CF	O	read-only
pulsQty	FLOAT32	CF	M	read-only

(1) *INT128 is required by the standard for conformance purposes but the INT128 type is not supported internally by G3200 and is understood as INT32 type. From a communication point of view, such variables have to be considered as INT32 values. This behavior is often implemented by third party devices.*

Note: *As a variable declaration, and for compliance with third party software and devices, BCR typed data can also be declared within the ICD/CID file of the G3200 as INT32 type. G3200 behavior will remain identical to the above behavior from a communication point of view.*

Measured value (MV)

Attribute name	Attribute type	FC	M/O/C	Comments
mag	AnalogueValue	MX	M	
q	Quality	MX	M	
t	TimeStamp	MX	M	
db	INT32U	CF	O	read-only
dataNs	VISIBLE STRING255	EX	C	for non standard data objects

Complex measured value (CMV)

Attribute name	Attribute type	FC	M/O/C	Comments
cVal	Vector	MX	M	
q	Quality	MX	M	
t	TimeStamp	MX	M	
db	INT32U	CF	O	read-only

Sampled value (SMV)

Common data class not supported.

WYE

Data name	Data class	FC	M/O/C	Comments
phsA	CMV		C	
phsB	CMV		C	
phsC	CMV		C	
neut	CMV		C	
res	CMV		C	
dataNs	VISIBLE STRING255	EX	C	for non standard data objects

Delta (DEL)

Data name	Data class	FC	M/O/C	Comments
phsAB	CMV		C	
phsBC	CMV		C	
phsCA	CMV		C	

Note:
M: mandatory field
O: optional field
C: conditional field

Sequence (SEQ)

Data name	Data class	FC	M/O/C	Comments
c1	CMV		M	
c2	CMV		M	
c2	CMV		M	

Harmonic value (HMV)

Common data class not supported.

Harmonic value for WYE (HWYE)

Common data class not supported.

Harmonic value for DEL (HDEL)

Common data class not supported.

Controllable single point (SPC)

Attribute name	Attribute type	FC	M/O/C	Comments
ctlVal	BOOLEAN	CO	C	
stVal	BOOLEAN	ST	C	
q	Quality	ST	C	
t	TimeStamp	ST	C	
ctlModel	CtlModels	CF	C	read-only
dataNs	VISIBLE STRING255	EX	C	for non standard data objects

Controllable double point (DPC)

Attribute name	Attribute type	FC	M/O/C	Comments
ctlVal	BOOLEAN	CO	C	
stVal	CODED ENUM	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
ctlModel	CtlModels	CF	C	read-only

Controllable integer status (INC)

Attribute name	Attribute type	FC	M/O/C	Comments
ctlVal	CtxInt	CO	C	
stVal	CtxInt	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
ctlModel	CtlModels	CF	C	read-only

Binary controlled step position information (BSC)

Common data class not supported.

Integer controlled step position information (ISC)

Common data class not supported.

Controllable analog set point information (APC)

Common data class not supported.

Single point setting (SPG)

Common data class not supported.

Note:
M: mandatory field
O: optional field
C: conditional field

Integer status setting (ING)

Common data class not supported.

Analogue setting (ASG)

Common data class not supported.

Setting curve (CURVE)

Common data class not supported.

Device name plate (DPL)

Attribute name	Attribute type	FC	M/O/C	Comments
vendor	VISIBLE STRING255	DC	M	
model	VISIBLE STRING255	DC	O	
location	VISIBLE STRING255	DC	O	

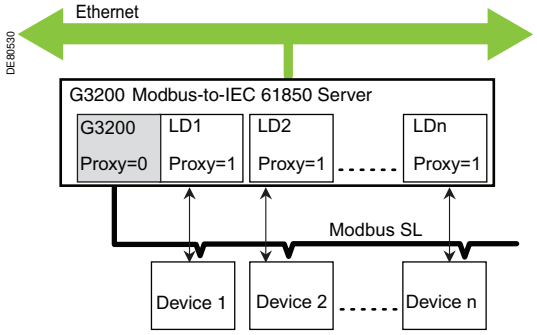
Logical node name plate (LPL)

Attribute name	Attribute type	FC	M/O/C	Comments
vendor	VISIBLE STRING255	DC	M	
swRev	VISIBLE STRING255	DC	M	
d	VISIBLE STRING255	DC	M	
configRev	VISIBLE STRING255	DC	C	LLN0 only
ldNs	VISIBLE STRING255	EX	C	LLN0 only

Curve shape description (CSD)

Common data class not supported.

Note:
M: mandatory field
O: optional field
C: conditional field



G3200 logical devices.

Logical device

G3200 global structure

The IEC 61850 server inside the G3200 contains the following logical devices:
■ A logical device dedicated to the G3200 unit itself. This logical device contains only LLN0 and LPHD logical nodes.
■ A logical device for each Modbus device connected to the G3200.The content of this logical device is defined by the device type, as described by its ICD file.
The PROXY attribute of the LPHD logical node is set to TRUE for logical devices representing the connected Modbus devices.

Logical devices names

The name of the logical devices is freely assigned at configuration time, using SFT850 tools, except for the G3200 logical device which has a fixed name of "G3200".

Logical nodes

The following LNs are mandatory for all the logical devices. The logical nodes corresponding to the electrical functions of the Modbus device have to be added with their attributes according to the modelling rules. See Specific syntax and rules for mapping Modbus devices, page 49.

System logical nodes: L group

Physical device information (LPHD class)

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	G3200	Connected Modbus device
LNName	Object Name	LPHD1		M	■	■
PhyName	DPL	Physical device name plate		M	■	■
PhyHealth	INS	Physical device health		M	■	■
Proxy	SPS	Indicates if this LN is a proxy		M	■	■

Logical node zero (LLN0 class)

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	G3200	Connected Modbus device
LNName	Object Name	LLN0		M	■	■
Common logical node information						
Mod	INC	Mode		M	■	■
Beh	INS	Behavior		M	■	■
Health	INS	Health		M	■	■
NamPlt	LPL	Name plate		M	■	■

Note:
M: mandatory data
O: optional data
C: conditional data
E: extension data
T: transient data (applies only to BOOLEAN attributes with FC=ST).
No event is generated for reporting when changing from TRUE to FALSE.

Capabilities description
PICS - Protocol implementation conformance statement

*The **Specific Communication Services Mapping** to MMS (ISO 9506) and to ISO/IEC 8802-3 is defined by part 8-1 of IEC 61850.*
It provides:
- *the mapping of the objects and services of the ACSI to MMS*
- *the mapping of time-critical information exchanges to ISO/IEC 8802-3.*

These conformance tables are taken from chapter 24 of IEC 61850-8-1.

Profile conformance

A-Profile support

Profile		Client	Server	Comments
A1	Client/server		■	
A2	GOOSE/GSE Management			
A3	GSSE			
A4	Time sync	■		

T-Profile support

Profile		Client	Server	Comments
T1	TCP/IP profile		■	
T2	OSI T profile			
T3	GOOSE/GSE T profile			
T4	GSSE T profile			
T5	Time Sync T profile	■		

MMS conformance

MMS service supported CBB (server)	M/O/C/I	Supported
status	M	■
getNameList	C	■
identify	M	■
rename	O	
read	C	■
write	C	■
getVariableAccessAttributes	C	■
defineNamedVariable	O	
defineScatteredAccess	I	
getScatteredAccessAttibutes	I	
deleteVariableAccess	O	
defineNamedVariableList	O	
getNamedVariablesListAttributes	C	■
deleteNamedVariableList	C	
defineNamedType	I	
getNamedTypeAttributes	I	
deleteNamedType	I	
input	I	
output	I	
takeControl	I	
relinquishControl	I	
defineSemaphore	I	
deleteSemaphore	I	
reportPoolSemaphoreStatus	I	
reportSemaphoreStatus	I	
initialDownloadSequence	I	
downloadSegment	I	
terminateDownloadSequence	I	
initiateUploadSequence	I	
uploadSegment	I	
terminateUploadSequence	I	
requestDomainDownload	I	
requestDomainUpload	I	
loadDomainContent	I	
storeDomainContent	I	
deleteDomain	I	
getDomainAttributes	C	■

Note:
M: mandatory support
O: optional support
C: conditional support
I: out of scope
X: must not be supported (version compatibility)

MMS conformance (cont.)

MMS service supported CBB (server)	M/O/C/I	Supported
createProgramInvocation	I	
deleteProgramInvocation	I	
start	I	
stop	I	
resume	I	
reset	I	
kill	I	
getProgramInvocationAttributes	I	
obtainFile	C	
defineEventCondition	I	
deleteEventCondition	I	
getEventConditionAttributes	I	
reportEventConditionStatus	I	
alterEventConditionMonitoring	I	
triggerEvent	I	
defineEventAction	I	
deleteEventAction	I	
alterEventEnrollment	I	
reportEventEnrollmentStatus	I	
getEventEnrollmentAttributes	I	
acknowledgeEventNotification	I	
getAlarmSummary	I	
getAlarmEnrollmentSummary	I	
readJournal	C	
writeJournal	O	
initializeJournal	C	
reportJournalStatus	I	
createJournal	I	
deleteJournal	I	
fileOpen	C	■
fileRead	C	■
fileClose	C	■
fileRename	I	
fileDelete	C	
fileDirectory	C	■
unsolicitedStatus	I	
informationReport	C	■
eventNotification	I	
attachToEventCondition	I	
attachToSemaphore	I	
conclude	M	■
cancel	M	■
getDataExchangeAttributes	X	
exchangeData	X	
defineAccessControlList	X	
getAccessControlListAttributes	X	
reportAccessControlledObjects	X	
deleteAccessControlList	X	
alterAccessControl	X	
reconfigureProgramInvocation	X	

Note:
M: mandatory support
O: optional support
C: conditional support
I: out of scope
X: must not be supported (version compatibility)

Capabilities description
PICS - Protocol implementation conformance statement

GOOSE service

GOOSE conformance	Subscriber		Publisher	
	M/O/C	**Supported**	**M/O/C**	**Supported**
GOOSE services	C		C	
SendGOOSEMessage	M		M	
GetGoReference	O		C	
GetGOOSEElementNumber	O		C	
GetGoCBValues	O		O	
SetGoCBValues	O		O	
GSENotSupported	C		C	
GOOSE Control Block (GoCB)	O		O	

GSSE conformance	Subscriber		Publisher	
	M/O/C	**Supported**	**M/O/C**	**Supported**
GSSE services	C		C	
SendGSSEMessage	M		M	
GetGsReference	O		C	
GetGSSEDataOffset	O		C	
GetGsCBValues	O		O	
SetGsCBValues	O		O	
GSENotSupported	C		C	
GSSE Control Block (GsCB)	O		O	

SCL services

SCL conformance			
		M/O/C	**Supported**
SCL.1	SCL file for implementation available (offline)	M	■
SCL.2	SCL file available from implementation online	O	
SCL.3	SCL implementation reconfiguration supported online	O	

Note:
M: mandatory support
O: optional support
C: conditional support
I: out of scope
X: must not be supported (version compatibility)

Capabilities description
PIXIT - Protocol implementation extra information for testing

Device configuration

The entire device configuration is read-only and can only be modified by the CID file. In particular, data objects with functional constraints of DC and CF can never be written.

ACSI models

Association model

Item	Value/Comments
Maximum simultaneous client associations	6
TCP Keepalive	1 to 60 seconds (default 30) (1)
Authentication	Not supported
Association parameters	
TSEL	Required, value defined in the CID file
SSEL	Required, value defined in the CID file
PSEL	Required, value defined in the CID file
AP-Title	Not required, ignored if present
AE-Qualifier	Not required, ignored if present
Maximum MMS PDU size	8000
Typical startup time after a power supply interrupt	20-100 seconds (depends on the CID configuration file). The status LED blinks quickly during startup.

***(1)** This is the time between two keepalive probes during normal operation. The session time-out, in case of communication failure, is related to this value in a non-linear way and ranges from approximately 50 seconds to approximately 150 seconds. It is about 90 seconds for the default keepalive value.*

Server model

Item	Value/Comments
Quality bits for analog values (MX)	
Validity	Good, Invalid
OutofRange	Supported
Failure	Supported
Inconsistent	Supported
Source	Process
Other quality bits and values	Not supported
Quality bits for status values (ST)	
Validity	Good, Invalid
BadReference	Supported
Failure	Supported
Inconsistent	Supported
Inaccurate	Supported
Source	Process
Other quality bits and values	Not supported
Maximum number of data values in Get/SetDataValues requests	Limited only by the MMS PDU size

Setting group model

Item	Value/Comments
Number of setting groups	2

Dataset model

Item	Value/Comments
Recommended predefined Datasets in the ICD files	■ 1 status Dataset **LLN0.StDs** ■ 1 measurand Dataset **LLN0.MxDs** in each Logical Device
Maximum number of data elements in one Dataset	No fixed limit, it depends on the available memory.
Maximum number of persistent Datasets	No fixed limit, it depends on the available memory.
Maximum number of non-persistent Datasets	Not supported

Capabilities description
PIXIT - Protocol implementation extra information for testing

Reporting model

Item	Value/Comments
Recommended predefined RCBs in the ICD files	■ 2 status RCBs **LLN0.brcbST01** and **LLN0.brcbST02**, based on **LLN0.StDs** ■ 2 measurands RCBs **LLN0.brcbMX01** and **LLN0.brcbMX02**, based on **LLN0.StMx** in each Modbus Logical Device
Support of trigger conditions	
Integrity	Supported
Data change	Supported
Data update	Supported (can be set, but there is no process data to report for this condition)
Quality change	Supported
General interrogation	Supported
Support of optional fields	
Sequence number	Supported
Report time-stamp	Supported
Reason for inclusion	Supported
Dataset name	Supported
Data reference	Supported
Buffer overflow	Supported
EntryID	Supported
Conf-rev	Supported
Segmentation	Supported
Sending of segmented reports	Supported
EntryID	Only the first 4 octets are used. Remaining octets must be 0.
Buffer size for each BRCB	30000 octets

Control model

Item	Value/Comments
Control models supported	
Status only	Supported
Direct with normal security	Supported
Direct with enhanced security	Not supported
SBO with normal security	Not supported
SBO with enhanced security	Supported
Time activated operate (operTm)	Not supported
Test mode	Not supported, ignored
Check conditions	Not supported, must be 0
Operate many	Not supported
Pulse configuration	Not supported
Command Termination timeout	15 seconds
Service error types	■ instance-not-available ■ access-violation ■ parameter-value-inappropriate ■ instance-locked-by-another-client ■ failed-due-to-server-constraint ■ generic-error

SBO controls

The value contained in the SBOw structure is ignored. It is possible to select several times the same control object. The select/operate timeout is restarted with each selection. The value contained in the Cancel structure is ignored. Controls with same ctlVal as current status are accepted.

Time and time synchronization model

Item	Value/Comments
Time quality bits	
LeapSecondsKnown	Not Supported
ClockFailure	Supported
ClockNotSynchronized	Supported
Maximum time to wait for time server responses	5 seconds
Meaning of ClockFailure bit	This bit is set when it is not possible to get time from any time server (or when the SNTP synchronization is not enabled).
Meaning of ClockNotSynchronized bit	This bit is set when the time server sets the alarm condition (clock not synchronized) in the SNTP frame (LI field).

Time stamps

Time stamping is performed in Sepam and Easergy T200 devices for process status values such as protection tripping, digital inputs changes…The time stamping of history variables, such as maximum demands, are also taken from Power Meter and Micrologic devices.
It is performed in the G3200 unit for any other data such as deadbanded analog values (all devices) and alarms (Power Meter and Micrologic devices).

G3200 clock

At power-up, the G3200 clock is reset to 2007/01/01 00:00.000. It is then synchronized to the SNTP servers if the feature is enabled and the servers are running. Modbus devices are synchronized from the G3200 module only if the ClockFailure status is not set.

File transfer model

Item	Value/Comments
Separator for files and directories path	'/'
Structure of files and directories	G3200: LD/LDName/COMTRADE/filename
Maximum length of names (incl. path)	64
Case sensitivity	Case sensitive

Capabilities description
PIXIT - Protocol implementation extra information for testing

Impact of device settings

Logical device mode
Provided that the Modbus device is of the correct type and communicates correctly with the G3200, the corresponding logical device mode (given by LLN0.Mod) is always ON.

Protection logical nodes
Protection logical nodes are OFF (**Mod** attribute), if the corresponding protection function is turned OFF in the Sepam and Micrologic units.

Some Protection Logical Nodes require a mandatory **Str** (Start) attribute. As such information is unavailable in Sepam and Micrologic devices, it is always provided as an OFF state and invalid quality.

Breaker-related Logical Nodes
Breaker-related logical nodes CSWI1 and XCBR1 rely on the breaker control function being turned ON in the Sepam and Micrologic devices. In Easergy T200 units, the logical nodes CSWI1 and XSWI1 provide the switch control function.

Controls
In order to be executed, controls must be enabled in the Modbus device. This is the case if the **Loc** attribute (available in every logical node containing controls) is OFF.

Analog values

Measurements

Units
Measurements are provided as floating point values with the following units:

Measurement type	Units
Current	1 A
Voltage	1 V
Power	1 kW, 1 kVA, 1 kvar
Energy	1 kWh, 1 kVArh
Temperature	1 °C
Angle	1 °
Rate	1 %

Deadbands
Default deadband values are provided in the CID file. These values can be changed. Unlike specified in IEC 61850-7-3, deadband values are not expressed as % but they are integer values in physical units, which are described in the CID file.

Creating a CID file
Obtaining or building an ICD file

Introduction

The G3200 provides connectivity of Modbus devices into a IEC 61850 network. A CID file is required to provide the G3200 with the necessary information for the communication architecture to work correctly. A CID file is built on a template called an ICD file.

This chapter describes:
- how to obtain an ICD file by:
  - sending a request by e-mail to Schneider Electric, to receive the ICD file available for a defined list of supported products.
  - building it from scratch using modelling rules and examples provided.
- how to build a CID file from the ICD file.

Obtaining ICD files

The ICD provides information to the G3200 about the data objects and services supported by the devices that are connected to it. The ICD files of some dedicated products are available on request. Send your request by e-mail to PowerLogic.G3200@schneider-electric.com

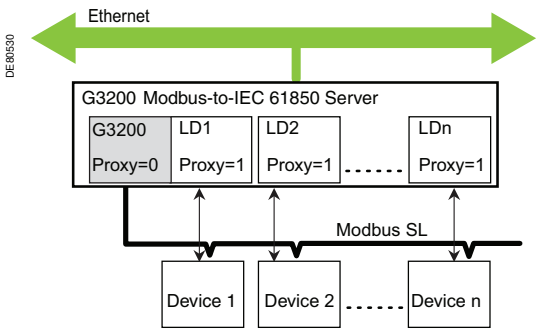
The ICD files are used in the generation of the CID file. See Building a CID file from an ICD file, page 48.

Building the ICD file from scratch

It is possible to create your own ICD file from scratch.

For detailed information on how to create your own ICD file:
- See Specific syntax and rules for mapping Modbus devices, page 49.
- See Processing codes, page 59.
- See Modelling examples, page 64.

The following sections are also useful reading when creating your own ICD file as they contain modelling frame information and examples of typical CID file content.



G3200 modelling.

Modelling frame information

The G3200 is considered as one Logical device that contains two mandatory logical nodes, LLN0 and LPHD. Each of the connected Modbus devices appears as a Logical device in the server.

In the simplest case, one Modbus device is connected to the G3200. However, depending on the complexity of the device in terms of Modbus zones and the response time of the device, it is possible to connect more than one Modbus device.

After the G3200 has been configured, it can be connected to the IEC 61850 network. See Installation, page 7.

Typical CID file content

A CID file has 3 main sections:

- a header
- an IED section
- a data type template

An example of the contents of a CID file is shown below:

PE80517

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:exse="http://www.schneider-electric.com"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Private type="SchneiderElectric-SFT-Key">1A60EADF5C788B2CD7058673908E7037</Private>
  <Private type="SchneiderElectric-SFT-EditTime">2009-08-21 15:18:59</Private>
  <Private type="SchneiderElectric-SFT-Version">2.0.23</Private>
  <Header id="My Project Id" nameStructure="IEDName" revision="0" toolID="SFT850 v2.0" version="1">...
  <Communication>...
  <IED configVersion="1.0" desc="IEC61850 server for modbus devices" manufacturer="Schneider Electric"
       name="GW51_" owner="My Project Id" type="G3200 Generic server">...
  <DataTypeTemplates>...
</SCL>
```

Header

The CID file header contains:

- the SCL syntax
- the MD2 key
- the date of creation of the file
- the communication parameters of the G3200 server

An example of the contents of a CID header is shown below:

PE80518

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
- <SCL xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:exse="http://www.schneider-electric.com"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <Private type="SchneiderElectric-SFT-Key">1A60EADF5C788B2CD7058673908E7037
    </Private>
    <Private type="SchneiderElectric-SFT-EditTime">2009-08-21 15:18:59</Private>
    <Private type="SchneiderElectric-SFT-Version">2.0.23</Private>
   - <Header id="My Project Id" nameStructure="IEDName" revision="0"
     toolID="SFT850 v2.0" version="1">
      <History>
        <Hitem revision="0" version="V1" what="Draft 1" when="2009-04-01"
         who="SFT850Config"/>
      </History>
    </Header>
  - <Communication>
    - <SubNetwork name="SN1">
      - <ConnectedAP apName="AP1" iedName="GW51_">
        - <Address>
            <P type="IP" xsi:type="tP_IP">10.155.24.146</P>
            <P type="IP-SUBNET" xsi:type="tP_IP-SUBNET">255.255.255.0</P>
            <P type="IP-GATEWAY" xsi:type="tP_IP-GATEWAY">10.155.24.1</P>
            <P type="OSI-PSEL" xsi:type="tP_OSI-PSEL">00000001</P>
            <P type="OSI-SSEL" xsi:type="tP_OSI-SSEL">0001</P>
             P type="OSI-TSEL" xsi:type="tP_OSI-TSEL">0001</P>
          </Address>
        </ConnectedAP>
      </SubNetwork>
    </Communication>
```

XML version, schema...

MD2 Key

Date of creation

G3200 communication parameters

IED section

The IED section contains the target for which the CID file is made (in this case, G3200), and a list of the logical devices contained by the server. Each Logical Device describes the IEC 61850 database to be created inside the G3200.

An example of the contents of an IED section is shown below:

PE80519

```
- <IED configVersion="1.0" desc="IEC61850 server for modbus devices"
    manufacturer="Schneider Electric" name="GW51_" owner="My Project Id"
    type="G3200 Generic    server">
    <Private type="SchneiderElectric-IED-Type">G3200</Private>
  + <Services>
  - <AccessPoint name="AP1">
    - <Server>
    - <LDevice desc="G3200 Log Dev" inst="LD0">
        <Private type="SchneiderElectric-SFT-IcdFileName">G3200/G3200_V0001.icd
        </Private>
        <!--.....-->
        <Private type="SchneiderElectric-IED-DevModel">00:GTW</Private>
        <Private type="SchneiderElectric-IED-MdbAddr">255</Private>
      + <LN0 desc="General" inst="" lnClass="LLN0" lnType="SE_LLN0_G3200_V001">
      + <LN desc="Device" inst="1" lnClass="LPHD" lnType="SE_LPHD_G3200_V001"
          prefix="">
      </LDevice>
    - <LDevice desc="Micrologic ELP" inst="LD1">
        <Private type="SchneiderElectric-SFT-IcdFileName">
          SE_Micrologic_ELP6.0-F01_E1V01.icd</Private>
        <!--.....-->
        <Private type="SchneiderElectric-IED-DevModel"> ELP:ELP7.0</Private>

        <Private type="SchneiderElectric-IED-CommType" > MODBUS </Private>


        <Private type="SchneiderElectric-IED-MdbAddr">47</Private>
        <Private type="SchneiderElectric-IED-MdbTbl">246:248:M:L</Private>
        <!--.....-->
      - <LN0 desc="" inst="" lnClass="LLN0" lnType="SE_LLN0_Micrologic_V001">
        - <DataSet desc="Default status reporting dataset" name="StDs">
            <FCDA doName="Op" fc="ST" ldInst="LD1" lnClass="PIOC" lnInst="1"
              prefix="A51G_"/>
            <!--.....-->
          </DataSet>

        - <ReportControl bufTime="500" buffered="true" confRev="1" datSet="MxDs"
            desc="Default Status Report" intgPd="0" name="brcbMX  " rptID="MxRpt">
            <TrgOps dchg="true" dupd="false" period="true" qchg="true"/>
            OptFields bufOvfl="false" configRef="true" dataRef="true" dataSet="true"
              entryID="true" reasonCode="true" segmentation="false" seqNum="true"
              timeStamp="true"/>
            </RptEnabled max="N"/>
          </ReportControl>

        - <DOI name="Mod">
            <Private type="SchneiderElectric-IED-PntRef">T:IO;L:P:305</Private>
          </DOI>
          <!--.....-->
        </LN0>
      + <LN desc="Physical device" inst="1" lnClass="LPHD"
          lnType="SE_LPHD_Micrologic_V001" prefix="">
      + <LN desc="Measurements" inst="1" lnClass="MMXU"
          lnType="SE_MMXU_Micrologic_V001" prefix="">
      + <LN desc="" inst="1" lnClass="PTOC" lnType="SE_PTOC_Micrologic_V001"
          prefix="">
      + <LN desc="Circuit breaker" inst="1" lnClass="XCBR"
          lnType="SE_XCBR_Micrologic_V001"
          prefix="">
      </LDevice>
      </Server>
    </AccessPoint>
```

This CID file belongs to the G3200

Logical Device G3200

ICD file of G3200 used to create this CID

G3200 mandatory LNs

Logical Device for Micrologic

DeviceModel string for Micrologic

Communication type for Micrologic

Modbus address for Micrologic

Modbus table inside Micrologic

Datasets and FCDAs (Appear only under LLN0)

Buffered Report Control Blocks (Appear only under LLN0); `max="N"` for `RptEnabled` creates the N instances of the report control block (brcbname01 to brcbnameN) for a given dataset

Data Objects attributes and their Modbus mappings (Can appear in all LNs)

Logical Node for physical device

Logical Nodes representing the electrical functions

Data type template

The data type template contains all possible types of LNs, DOs and DAs that appear in the server.

An example of the contents of a data type template is shown below:

PE80520

```
- <IED configVersion="1.0" desc="IEC61850 server for modbus devices"
    manufacturer="Schneider Electric" name="GW51_" owner="My Project Id"
    type="G3200 Generic    server">
    <Private type="SchneiderElectric-IED-Type">G3200</Private>
   +<Services>

 -<DataTypeTemplates>
    -<LNodeType id="SE_XCBR_Micrologic_V001" iedType="" lnClass="XCBR">
       <DO name="Pos" transient="false" type="SE_Dpc_Micrologic_V001"/>
     </LNodeType>
    -<DOType cdc="DPC" id="SE_Dpc_Micrologic_V001" iedType="">
       <DA bType="Dbpos" count="0" dchg="true" dupd="false" fc="ST"
           name="stVal" qchg="false" valKind="Set"/>
       <DA bType="Timestamp" count="0" dchg="false" dupd="false" fc="ST"
           name="t" qchg="false" valKind="Set"/>
       <DA bType="Struct" count="0" dchg="false" dupd="false" fc="CO"
           name="SBOw" qchg="falsetype="oper" valKind="Set"/>
       <DA bType="Struct" count="0" dchg="false" dupd="false" fc="CO"
           name="Cancel" qchg="false" type="cancel" valKind="Set"/>
       <DA bType="Struct" count="0" dchg="false" dupd="false" fc="CO"
           name="Oper" qchg="false" type="oper" valKind="Set"/>
      -<DA bType="Enum" count="0" dchg="false" dupd="false" fc="CF"
           name="ctlModel" qchg="false" type="CtlModel" valKind="RO">
         <Val>sbo-with-enhanced-security</Val>
         DA>
       <DA bType="INT32U" count="0" dchg="false" dupd="false" fc="CF"
           name="sboTimeout" qchg="false" valKind="RO"/>
      - <DA bType="Enum" count="0" dchg="false" dupd="false" fc="CF"
           name="sboClass" qchg="false" type="SboClass" valKind="RO">
         <Val>operate-once</Val>
       </DA>
     </DOType>
   - <DAType id="originator" iedType="">
       <BDA bType="Enum" count="0" name="orCat" type="Orcategory"
            valKind="Set"/>
       <BDA bType="Octet64" count="0" name="orIdent" valKind="Set"/>
     </DAType>
   - <EnumType id="CtlModel">
       <EnumVal ord="0">status-only</EnumVal>
       <EnumVal ord="1">direct-with-normal-security</EnumVal>
       <EnumVal ord="2">sbo-with-normal-security</EnumVal>
       <EnumVal ord="3">direct-with-enhanced-security</EnumVal>
       <EnumVal ord="4">sbo-with-enhanced-security</EnumVal>
     </EnumType>
 </DataTypeTemplates>
```

Logical Node Types referring to the Data Object Types

Data object Type listing the types of all the Data Attribute under the instantiable Data Object

Data Attribute Types describe the types of Basic Data Attributes which hold the actual data

Enumeration Types defined by the standard or by the user and referred to by Data Attribute Types

Creating a CID file
Building a CID file from an ICD file

The procedure below describes a manual method of creating a CID file from an ICD file using the SFT850 editor.

Note: *Other types of XML editor can be used to edit the CID file.*

1. Store in a folder all the ICD files of the Modbus devices to be connected in the IEC 61850 communication network, including the ICD file of the G3200.
2. In Windows Explorer, change the extension of the `.icd` file of the G3200 to `.cid` and open it with SFT850.
3. In the SFT editor, click **Tools > Preferences**:
   - Uncheck **Automatic validation at file saving** and **Automatic validation at file opening**.
   - Check **Enable XML source editing**.
4. To edit the file, click **View > XML Source**.
5. Open the ICD file of the IED (Modbus device) with the SFT850 editor
6. Copy the entire content of the `<LDevice></LDevice>` section of this ICD file of the Modbus device to directly below the `<LDevice></LDevice>` section of the CID file you are editing.

Note: *The "inst'" of the LDevice section must be unique for each logical device, usually LD0 for G3200 and LD1 for the IED.*
The "ldInst" of the FCDAs under a logical device must be same as the "inst" of the corresponding logical device.

7. Copy the entire content of the `<DataTypeTemplates>` section of the ICD file of the IED to inside the `<DataTypeTemplates>` section of the CID file.
8. If you need to connect more than one IED, append the `<LDevice>` and `<DataTypeTemplates>` of the additional IED below the corresponding sections in the CID file you are editing. Increment the logical device "inst" for successive IEDs.
9. Save the CID file with the desired name. The SFT850 adds the MD2 key in the third line of the file. The CID file is ready for use.

When your CID file is ready, you can download it into the G3200. See Download of CID file, page 19.

Appendix A
Specific syntax and rules for mapping Modbus devices

Private tags

An ICD file describes the capabilities of an IED in terms of the data objects and the services that are supported by the device. The ICD files for the products connected to the G3200 must follow the same syntax, schema and structure described by the IEC 61850 standard.

Schneider Electric also provides certain rules and syntaxes to map the Modbus devices to the IEC 61850 server. This appendix contains these rules, which describe how to map the Modbus register objects into corresponding IEC 61850 data objects.

The rules are encoded inside the private tags identified as
`<Private type="SchneiderElectric...">Tag value</Private>`
where:

- brown text indicates the name of the XML tag,
- red text indicates the name of the XML attribute,
- blue text indicates the value of the XML attribute, which is always enclosed between inverted commas (''),
- black text indicates the value of the XML tag.

The table below lists the private tags that occur at different levels of the SCL schema.

Tag	Tag value
LDevice level private tags	
`<Private type="SchneiderElectric-SFT-IcdFileName">Tag value</Private>`	Name of the ICD file
`<Private type="SchneiderElectric-SFT-IedVersion">Tag value</Private>`	IED version if any
`<Private type="SchneiderElectric-SFT-IedName">Tag value</Private>`	Name of the IED
`<Private type="SchneiderElectric-SFT-IedFamily">Tag value</Private>`	Name of the IED family if any
`<Private type="SchneiderElectric-SFT-IedAppli">Tag value</Private>`	Name of the application or configuration or use-case of the product
`<Private type="SchneiderElectric-IED-DevModel">Tag value</Private>`	See Defining Device Model strings, page 50.
`<Private type="SchneiderElectric-IED-CommType">Tag value</Private>`	See Defining Communication Type strings, page 51.
`<Private type="SchneiderElectric-IED-MdbAddr">Tag value</Private>`	Modbus address assigned to the IED from the range of 1-247
`<Private type="SchneiderElectric-IED-MdbTbl">Tag value</Private>`	See Defining the Modbus Register table, page 51.
DOI/SDI/DAI level Private Tags	
`<Private type="SchneiderElectric-IED-PntRef">Tag value</Private>`	See Defining Point Reference maps, page 53.

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Defining Device Model strings

The Device Model private tag contains the information needed to check that the correct Modbus device model is connected at the selected Modbus address. The information consists of the `series` of the device and its `configuration`. This is done by using the private tag shown below, located at the corresponding LD level:

```
<Private type="SchneiderElectric-IED-DevModel">
series:configuration</Private>
```

The setting of the Device Model string affects the behavior of the G3200 and the management of communication with the Modbus device. See Modbus device connection checking, page 20.

The Device Model string is also used to display the real list of active LDs and active associated status in the G3200 summary web page.

The `series` string is used to express the family of the device. The `configuration` string is used to express the device type.

Predefined Device Model strings

If the Modbus SL device is already part of the list below, the `series` and `configuration` fields must be filled in as shown in the table below:

Device	series	configuration
Micrologic	ELA	ELA5.0
	ELP	ELP6.0
	ELH	ELH7.0
Power Meter	800	PM810
	800	PM820
	800	PM850
	800	PM870
	700	PM710
	700	PM750
	200	PM210
Circuit Monitor	4000	CM4000
	4000	CM4250
ION Meter	7300	ION7300
	7550	ION7550
	7650	ION7650
	8600	ION8600
	8800	ION8800
	7500	ION7500
	7600	ION7600
Easergy T200	T200	T200
Sepam 2000	2000	S25
	2000	S26
	2000	S35
	2000	S36
	2000	S46
TeSys T	TeSysT	LTMR08MBD
	TeSysT	LTMR27MBD
	TeSysT	LTMR100MBD
PXP	PXP	PXP

The G3200 automatically ensures that the correct Modbus device type is connected at the selected Modbus address.

Unknown Device Model strings

If the device is not in the above table, then `series` must be equal to "UNK" and `configuration` can be filled by a string (maximum length 8 characters) describing the corresponding device type. The G3200 does not perform any tests to verify that the connected device matches the expected type given in the CID file.

Device	series	configuration
Unknown device	UNK	Name of the device type

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Specific syntax and rules for mapping Modbus devices

Defining Communication Type strings

The Communication Type private tag indicates the type of communication supported by the device. Its syntax is as follows:

```
<Private type="SchneiderElectric-IED-CommType">
Communication type</Private>
```

The Communication Type should be either `MODBUS` or `JBUS`. In Modbus, the register address is reduced by one and then used to read the value from the device. In Jbus, the register address directly is used to read the value from the device.

The table below shows the Communication Type of the devices supported by the G3200.

Device	Communication type
Micrologic	MODBUS
Power Meter	MODBUS
Circuit Monitor	MODBUS
ION Meter	MODBUS
Sepam 2000	JBUS
TeSys T	JBUS
PXP	MODBUS

Defining the Modbus Register table

The Modbus Register table private tag describes a range of contiguous Modbus register addresses that are polled by the G3200. A block of Modbus registers is defined using the private tag:

```
<Private type="SchneiderElectric-IED-MdbTbl">
StartAddress:EndAddress:TableType:Priority</Private>
```

This tag can have multiple occurrences. It describes the tables of registers in the device that the G3200 accesses to obtain the features described in the ICD file. The tables must cover all the read/write registers and coils that appear in the later part of the ICD files.

The table below shows the content of the Modbus Register table private tag.

Field name	Description	Formatting rules	Examples
StartAddress	Modbus starting register address	Hexadecimal format	C10
EndAddress	Modbus ending register address	Hexadecimal format	C15
TableType	Type of Modbus access	One of the following single character values: ■ Read types: □ S: status values □ M: measured values ■ Write types: □ C: control values	S, C
Priority	Defines the relative priority access to the table	Priority is used only with tables of type "M". One of the following single character values: ■ H: high frequency (read as fast as possible) ■ N: normal priority (default) ■ L: low priority (slow reading) The actual rates of H, N, and L are implementation-specific and cannot be defined by the ICD file. Priority is optional. If not specified, it is by default "N" Normal priority.	N, L

Examples of Modbus Register table private tags

```
<Private type="SchneiderElectric-IED-MdbTbl">200:291:M
</Private>
<Private type="SchneiderElectric-IED-MdbTbl">400:421:M:L
</Private>
<Private type="SchneiderElectric-IED-MdbTbl">A00:A11:M:H
</Private>
<Private type="SchneiderElectric-IED-MdbTbl">C10:C15:S
</Private>
<Private type="SchneiderElectric-IED-MdbTbl">C88:C8B:C
</Private>
```

Appendix A
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Rules for defining Modbus register tables

It is important to follow the rules below when defining the Modbus register tables:

■ The size of the table (end address - start address + 1) must never exceed 125. This limitation comes from the Modbus protocol.

■ All registers must be covered by the table.

■ All data objects that start from a register address, but can extend up to consecutive registers, must be covered. For example, the Nameplate of a device can start at address 3201 and can extend up to 20 characters. In this case, the table must cover up to 3210.

■ Tables must be exclusive and not overlap. For example, two different Modbus tables with starting and ending addresses 1000:1008 and 1006:1020 may be better written as one table 1000:1020.

■ It is possible to merge several small tables separated by a small distance to make a bigger table, even if the new table includes some unwanted registers.

■ The use of priority is not recommended in normal cases but can be useful in specific cases:

□ If the Modbus response of the device is too slow, or if the device has too many registers to be accessed, the dynamics may need to be optimized.

- Use priority "H" if a fast response is required for some objects, for example, I/O or apparatus status.
- Use priority "L" for large tables of data with dynamics that are not very important.

□ If the update frequency of certain application data is more or less important, priority can also be used.

- Use "H" Priority to read important application data more frequently. For example, breaker status is an important time-critical parameter and so it is desirable to give "H" priority to the Modbus table containing the breaker status register.
- Use "L" priority for data that has a slow update period on the device, for example, energy counters with a 10-second update period.

■ The number of high and low priority tables is restricted. For optimized performance, a maximum of 2 high priority tables and 5 low priority tables is allowed. The number of registers in each high priority table is limited to 20.

■ For a table of Modbus coils (table type "C"), the table must cover the word address (or base address) which consists of 16 bits (coils) and not the actual bit address of the coil. For example, if the bit address of the coil to be modelled is C895 (hexadecimal), then 0C89 (hexadecimal) must be included inside the Modbus table.

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Defining Point Reference maps

The IED-PntRef private tag maps the Modbus objects to the corresponding IEC 61850 objects. The tag can appear at the DOI, SDI or at the DAI level. The IED-PntRef private tag is also used to map alarms. See Alarm mapping description, page 54. The usage of this private tag is given below:

```
<Private type="SchneiderElectric-IED-PntRef">
Type;RegisterDescription1; …
RegisterDescriptionN;ProcessingCode</Private>
```

When only one attribute (usually the primary attribute) of an IEC 61850 object has a corresponding Modbus register in the device, the mapping is done at the DOI level. This is the most common case, called the "object level mapping", where the specified Modbus object is mapped by default to the primary data attribute of the DO. Sometimes an object includes a sub-object instead of directly including attributes. In this case, the private tag for mapping must be placed at the SDI level. In cases where there are many attributes in an object, each of which can be independently mapped to the separate Modbus registers, apply the "attribute level mapping". The private mapping tags in this case are placed under the DAI.

A mapping string is a combination of number of fields, each separated by a semicolon. Each mapping string is used to inform the G3200 of the scale, range, size and logic to be applied to the Modbus register(s) of the designated address, so that the raw values in the register(s) are converted in to the IEC 61850 attribute value of the required type.

Type string

The `Type` string has to be expressed differently in object level and attribute level mapping.

Object level

An object type field is indicated by the uppercase letter "T" followed by a colon and two uppercase letters describing the IEC 61850 Common Data Class. This field must be present and is used only for mapping Modbus registers at the IEC Data Object level.

The following table lists the object types currently defined:

Type	IEC 61850 Common Data Class
SS	SPS - Single Point Status
DS	DPS - Double Point Status
IS	INS - Integer Status (Integer)
ES	INS - Integer Status (Enumerated) from edition 1
IC	INC - Integer Status Controllable (control & status)
IO	INC - Integer Status Controllable (status only)
IN	INC - Integer Status Controllable (control only)
SC	SPC - Single Point Controllable (control & status)
SO	SPC - Single Point Controllable (status only)
SN	SPC - Single Point Controllable (control only)
DC	DPC - Double Point Controllable (control & status)
DO	DPC - Double Point Controllable (status only)
DN	DPC - Double Point Controllable (control only)
MV	MV - Measured Value
CM	CMV - Complex Measured Value
BC	BCR - Binary Counter Reading
AT	ACT - ACtivation
AD	ACD - ACtivation Directional
ST	String
UT	UTC1 time

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Attribute level

The Attribute type field is indicated by the uppercase letter "A" followed by a colon and two characters describing the IEC 61850 Attribute Type. Attributes are defined by the "Basic Types" listed in the table below, in addition the Timestamp and Quality types. This field is only used for mapping Modbus registers at the IEC Attribute level. It is not possible to have a T:xx and an A:xx field in the same < private PntRef > tag.

The following table lists the attribute types currently defined:

Type	IEC 61850 Attribute
BO	BOOLEAN
I1	INT8
I2	INT16
I3	INT24
I4	INT128
U1	INT8U
U2	INT16U
U3	INT24U
U4	INT32U
F4	FLOAT32
F8	FLOAT64
EN	ENUMERATED
CE	CODED ENUM
OC	OCTET STRING
VS	VISIBLE STRING
US	UNICODE STRING
TS	Timestamp
QT	Quality

RegisterDescription

A mapping string can contain one or more `RegisterDescription` fields with the following structure:
`RegisterType:Address:<OptionalFields>`

RegisterType

`RegisterType` can be one of the following single uppercase or lowercase letters:
- m/M, which stands for Modbus holding registers
- c/C, which stands Modbus control coils
- s/S, which stands for Modbus status coils
- i/I, which stands for Modbus input registers

Address

- If the `RegisterType` is lowercase, `Address` should be decimal.
- If the `RegisterType` is uppercase, `Address` should be hexadecimal.

Take care to write the address which gives the correct response for the Modbus read function. For example, in some devices decrementing the address by 1 obtains the correct data. In other cases, the data sheet of the device may represent holding registers as 4xxxx but to get the response, you may have to address xxxx.

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OptionalFields

`OptionalFields` are different for "M" type and "S" type. They should appear in order.

1. Bit masking

If `RegisterType` is m/M, the optional field for bit masking looks like `Address:oooo:zzzz:N/I`
where:
- oooo is ones mask in hexadecimal format,
- zzzz is zeros mask in hexadecimal format, and
- N/I indicates positive or negative logic, i.e. normal or inverted. If absent, treat as normal logic.

The table below gives the Output values of the IEC 61850 attribute according to the bit masking:

If...	and if...	then Output =
only ones mask (oooo) is present	register value AND oooo is the same as oooo value	1
only ones mask (oooo) is present	register value AND oooo is not the same as oooo value	0
only zeros mask (zzzz) is present	register value AND zzzz is 0	1
only zeros mask (zzzz) is present	register value AND zzzz is not 0	0
both masks are present	register value AND oooo is the same as oooo && (register value AND zzzz == 0)	1
both masks are present	register value AND oooo is not the same as oooo or (register value AND zzzz != 0)	0

2. Size, Scaling, Offset and Boundary checking

If `RegisterType` is m/M, then optional field for scaling and offset looks like `size:scale:[lowerBound:]upperBound;O:offset`

Size can be expressed in 2 ways:
- Bits with upper case letters 32U/32S/16U/16S
- Register size from u1 to u10 or s1 to s10

where:
- 32U represents unsigned data in the 32-bit register
- 16S represents signed data in the 16-bit register
- s1 is a signed 16-bit register (one register)
- u2 is an unsigned 32-bit register (two 16-bit registers)
- u10 is ten unsigned 16-bit contiguous registers

The output is calculated from the register value after applying the scale and offset as follows:
- Output = scale*(register value + offset).
- Offset is always a signed value.
- By default, and if not explicitly mentioned, scale = 1.0 and offset = 0.

Scale can be expressed in 3 different ways:
- Scale can be a floating value. Example: scale = 0.33
- Scale can be expressed by using N:P, where P is a signed integer. In this case, scale = 10^P. Example: for N:-3, scale = 10^-3 = 0.001
- The Scale factors themselves can be stored in some registers of the device. In these cases, the scale is represented as R:ScalingRegister. In this case, scale = 10^(value of ScalingRegister)

Example: for R:3209, scale = 10^(value in the register 3209)

The lower and upper bounds are used to define the acceptable range of values from a Modbus data point:
- `lowerBound` defines the lowest valid value for the Modbus reference.
- `upperBound` defines the highest valid value for the Modbus reference.

Either one of these bounds or both together can be applied on the Modbus reference.

Note: *The sign of the lowerbound and upperbound must be same as the sign convention of the Modbus point.*

Processing codes

Processing codes are given in a separate appendix. See Processing codes, page 59.

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Alarm mapping description

An alarm is a notification of a certain event. An event can be a change in the status, an occurrence of a value exceeding a threshold or change of a digital contact.

Alarms in Micrologic, Power Meter and Circuit Monitor

The alarms are considered as IEC objects under a group of logical nodes. Alarms have a unique object reference as per the standard or as named by the PowerLogic SCADA modelling. Mapping to the actual alarm in the device is done by using the IED-PntRef private tag:

```
<Private type="SchneiderElectric-IED-PntRef">
T:ALM;F:FileNo;q:AlarmNo:Bitmask</Private>
```

where:

- ALM is the Type Alarm,
- FileNo is the file number from which the event has to be retrieved,
- AlarmNo is the alarm number in Micrologic or the alarm unique ID in Power Meter and Circuit Monitor,
- Bitmask is used to find the type of alarm (over, under, etc.) in Micrologic. In Power Meter and Circuit Monitor, it is used to find the active evaluation status summary.

Example: Data object "over current demand alarm" PTOC1\Op1\dchg is mapped as:

```
<Private type="SchneiderElectric-IED-PntRef">
T:ALM;F:20;q:1017:1</Private>
```

Alarms in Sepam and Easergy

Alarms or events in Sepam and Easergy are mapped to bit address status registers. For other devices, there is currently no support for alarms in the G3200. The private tag used is:

```
<Private type="SchneiderElectric-IED-PntRef">
T:TYPE;S:bSA1;S:bSA2</Private>
```

where:

- TYPE is the type DO, for example, SS, DS etc.
- bSA1 is the bit address for the first status bit.
- bSA2 is bit address for the second status bit.

Example:

```
<Private type="SchneiderElectric-IED-PntRef">
T:SS;S:340;S:341</Private>
```

Command interface description

In Sepam and Easergy, control DOs are mapped to control registers. In this case, G3200 does a coil write to the mapped control registers. But, because Micrologic, Circuit Monitor and Power Meter do not have control registers, all the control operations are executed as command interfaces.

Each control action has an associated command code and command parameters that are written into predefined holding registers. There is no mapping for the command data objects in the ICD. The mapping is done inside the firmware of the G3200.

The command interface is supported by Micrologic, Power Meter and Circuit Monitor devices only. No other commands are supported.

Micrologic supported commands

Command	IEC tag
Reset Accumulated Energy	MMTR1\ZRsTot
Reset Breaker Event Log	LPHD1\ZRsCBEvt
Reset Device Date/Time	LPHD1\ZRsDateTm
Reset Min/Max	SLR_MSTA1\ZRsMinMax
Reset Operations Counter	XCBR1\ZRsOpCnt
Reset Peak Demand Current	MSTA1\RsMaxA
Reset Peak Demand Power	MSTA1\RsMaxPwr
Reset Trip Unit Alarm Log	LPHD1\ZRsTrUntAlm
Operate Breaker	CSWI1\Pos

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Power Meter supported commands

Command	IEC tag
Reset Accumulated Energy	MMTR1\ZRsTot
Reset Alarm Summary	LPHD1\ZRsAlmSum
Reset Conditional Energy	CND_MMTR1\ZRsEnr
Reset Device Date/Time	LPHD1\ZRsDateTm
Reset EN50160 Evaluation	LPHD1\ZRsENEval
Reset Energy Trending	LPHD1\ZRsEnrTrend
Reset Incremental Energy Interval	PII_MMTR1\ZRsEnrInt
Reset Input Metering Accum. All Channels	GGIO1\ZRsInMtrCh
Reset Input Metering Accum. Channel 1	GGIO1\ZRsInMtrCh1
Reset Input Metering Accum. Channel 2	GGIO1\ZRsInMtrCh2
Reset Input Metering Accum. Channel 3	GGIO1\ZRsInMtrCh3
Reset Input Metering Accum. Channel 4	GGIO1\ZRsInMtrCh4
Reset Input Metering Accum. Channel 5	GGIO1\ZRsInMtrCh5
Reset Meter Initialization	LPHD1\ZMtrInit
Reset Min/Max (Past Month)	PMO_MSTA1\ZRsMinMax
Reset Min/Max (Present Month)	CMO_MSTA1\ZRsMinMax
Reset Onboard Alarm Log	LPHD1\ZRsAlm
Reset Onboard Billing Log	LPHD1\ZRsBill
Reset Onboard Data Log 1	LPHD1\ZRsData1
Reset Onboard Data Log 2	LPHD1\ZRsData2
Reset Onboard Data Log 3	LPHD1\ZRsData3
Reset Peak Demand	MSTA1\RsMax
Reset Peak Demand Current	MSTA1\RsMaxA
Reset Peak Demand Power	MSTA1\RsMaxPwr
Reset Power Quality Summary	LPHD1\ZRsPQSum
Reset Shift Energy Summary	LPHD1\ZRsSESum
Reset Uptime Statistics	LPHD1\RsStat
Reset Trending and Forecasting	LPHD1\ZRsTrFor
Reset WFC Log	LPHD1\ZRsWFC
Operate PM8 P22 Slot 1 IO Point 1	P22_GGIO1\ZMtrDPC1\Pos
Operate PM8 P22 Slot 1 IO Point 2	P22_GGIO1\ZMtrDPC2\Pos
Operate PM8 P22 Slot 2 IO Point 1	P22_GGIO2\ZMtrDPC1\Pos
Operate PM8 P22 Slot 2 IO Point 2	P22_GGIO2\ZMtrDPC2\Pos
Operate PM8 P26 Slot 1 IO Point 1	P26_GGIO1\ZMtrDPC1\Pos
Operate PM8 P26 Slot 1 IO Point 2	P26_GGIO1\ZMtrDPC2\Pos
Operate PM8 P26 Slot 2 IO Point 1	P26_GGIO2\ZMtrDPC1\Pos
Operate PM8 P22 Slot 2 IO Point 2	P26_GGIO2\ZMtrDPC2\Pos
Operate PM8 P2x Slot 1 IO Point 1	P2x_GGIO1\ZMtrDPC1\Pos
Operate PM8 P2x Slot 1 IO Point 2	P2x_GGIO1\ZMtrDPC2\Pos
Operate PM8 P2x Slot 2 IO Point 1	P2x_GGIO2\ZMtrDPC1\Pos
Operate PM8 P2x Slot 2 IO Point 2	P2x_GGIO2\ZMtrDPC2\Pos
Operate Standard KY Relay	GGIO1\ZMtrDPC1\Pos

Circuit Monitor supported commands

Command	IEC tag
Reset 100ms RMS Log	LPHD1\ZRs100ms
Reset Accumulated Energy	MMTR1\ZRsTot
Reset Adaptive WFC Log	LPHD1\ZRsAWFC
Reset Alarm Summary	LPHD1\ZRsAlmSum
Reset Conditional Energy	CND_MMTR1\ZRsEnr
Reset Device Date/Time	LPHD1\ZRsDateTm
Reset Disturbance WFC Log	LPHD1\ZRsDWFC
Reset EN50160 Evaluation	LPHD1\ZRsENEval
Reset Energy Summary	LPHD1\ZRsEnrSum
Reset Energy Trending	LPHD1\ZRsEnrTrend
Reset Incremental Energy Interval	PII_MMTR1\ZRsEnrInt
Reset Input Metering Accum. All Channels	GGIO1\ZRsInMtrCh
Reset Input Metering Accum. Channel 1	GGIO1\ZRsInMtrCh1
Reset Input Metering Accum. Channel 10	GGIO1\ZRsInMtrCh10
Reset Input Metering Accum. Channel 2	GGIO1\ZRsInMtrCh2
Reset Input Metering Accum. Channel 3	GGIO1\ZRsInMtrCh3
Reset Input Metering Accum. Channel 4	GGIO1\ZRsInMtrCh4
Reset Input Metering Accum. Channel 5	GGIO1\ZRsInMtrCh5
Reset Input Metering Accum. Channel 6	GGIO1\ZRsInMtrCh6
Reset Input Metering Accum. Channel 7	GGIO1\ZRsInMtrCh7

Circuit Monitor supported commands (cont.)

Command	IEC tag
Reset Input Metering Accum. Channel 8	GGIO1\ZRsInMtrCh8
Reset Input Metering Accum. Channel 9	GGIO1\ZRsInMtrCh9
Reset Meter Initialization	LPHD1\ZMtrInit
Reset Min/Max	SLR_MSTA1\ZRsMinMax
Reset Min/Max/Avg Interval Log	LPHD1\ZRsMMAIntv
Reset Onboard Alarm Log	LPHD1\ZRsAlm
Reset Onboard Data Log 1	LPHD1\ZRsData1
Reset Onboard Data Log 10	LPHD1\ZRsData10
Reset Onboard Data Log 11	LPHD1\ZRsData11
Reset Onboard Data Log 12	LPHD1\ZRsData12
Reset Onboard Data Log 13	LPHD1\ZRsData13
Reset Onboard Data Log 14	LPHD1\ZRsData14
Reset Onboard Data Log 2	LPHD1\ZRsData2
Reset Onboard Data Log 3	LPHD1\ZRsData3
Reset Onboard Data Log 4	LPHD1\ZRsData4
Reset Onboard Data Log 5	LPHD1\ZRsData5
Reset Onboard Data Log 6	LPHD1\ZRsData6
Reset Onboard Data Log 7	LPHD1\ZRsData7
Reset Onboard Data Log 8	LPHD1\ZRsData8
Reset Onboard Data Log 9	LPHD1\ZRsData9
Reset Peak Demand	MSTA1\RsMax
Reset Peak Demand Current	MSTA1\RsMaxA
Reset Peak Demand Power	MSTA1\RsMaxPwr
Reset Power Quality Summary	LPHD1\ZRsPQSum
Reset Shift Energy Summary	LPHD1\ZRsSESum
Reset Uptime Statistics	LPHD1\RsStat
Reset Steady-State WFC Log	LPHD1\ZRsSSWFC
Reset Transient Waveform Reset	LPHD1\ZRsTWF
Reset Trending and Forecasting	LPHD1\ZRsTrFor
Operate CM4 C2x Slot 1 IO Point 1	C2x_GGIO1\ZMtrDPC1\Pos
Operate CM4 C2x Slot 1 IO Point 2	C2x_GGIO1\ZMtrDPC2\Pos
Operate CM4 C2x Slot 2 IO Point 1	C2x_GGIO2\ZMtrDPC1\Pos
Operate CM4 C2x Slot 2 IO Point 2	C2x_GGIO2\ZMtrDPC2\Pos
Operate CM4 C44 Slot 1 IO Point 5	C44_GGIO1\ZMtrDPC1\Pos
Operate CM4 C44 Slot 1 IO Point 6	C44_GGIO1\ZMtrDPC2\Pos
Operate CM4 C44 Slot 1 IO Point 7	C44_GGIO1\ZMtrDPC3\Pos
Operate CM4 C44 Slot 1 IO Point 8	C44_GGIO1\ZMtrDPC4\Pos
Operate CM4 C44 Slot 2 IO Point 5	C44_GGIO2\ZMtrDPC1\Pos
Operate CM4 C44 Slot 2 IO Point 6	C44_GGIO2\ZMtrDPC2\Pos
Operate CM4 C44 Slot 2 IO Point 7	C44_GGIO2\ZMtrDPC3\Pos
Operate CM4 C44 Slot 2 IO Point 8	C44_GGIO2\ZMtrDPC4\Pos
Operate CM4 IOX Slot 3 IO Point 1	IOX_GGIO3\ZMtrDPC1\Pos
Operate CM4 IOX Slot 3 IO Point 2	IOX_GGIO3\ZMtrDPC2\Pos
Operate CM4 IOX Slot 3 IO Point 3	IOX_GGIO3\ZMtrDPC3\Pos
Operate CM4 IOX Slot 3 IO Point 4	IOX_GGIO3\ZMtrDPC4\Pos
Operate CM4 IOX Slot 3 IO Point 5	IOX_GGIO3\ZMtrDPC5\Pos
Operate CM4 IOX Slot 3 IO Point 6	IOX_GGIO3\ZMtrDPC6\Pos
Operate CM4 IOX Slot 3 IO Point 7	IOX_GGIO3\ZMtrDPC7\Pos
Operate CM4 IOX Slot 3 IO Point 8	IOX_GGIO3\ZMtrDPC8\Pos
Operate Standard KY Relay	GGIO1\ZMtrDPC1\Pos

Editing deadbands

The deadband check is done on the raw value of the register.

Note: *When changing the deadband values, the scale and unit of the corresponding variable need to be taken into consideration.*

Appendix B
Processing codes

■ Processing codes define the rules or formulas applied on the raw data read from the Modbus registers.
■ The processing code is presented as L:P:K, where K is a positive number ranging from 1 to N.
■ It is important to select the appropriate processing code to suit the device.

The logic code denotes how to interpret or decode the data in a register, consecutive registers or a set of registers. It also specifies the logic to be applied on a set of registers to obtain the output. When the formula is applied to a set of registers, the resultant output is treated as the value of the attribute of the corresponding IEC 61850 object.

Processing codes are divided into groups based on the type of data to which these rules are applied. The table below lists the supported processing codes.

Group name	Logical code range
Date/time	1-8
Modulo 10K	10-13
Values with bitmasks	20-29 and 226-229
Scaled registers	30-37
Strings	39
Maths operations on scale registers	40-46
Power factor	50-54
Unique situations	300-312
Write	101-103

Logic code	Register definition	Processing description	Device support	Example of usage
Date/time processing codes				
L:P:1	3 sequential registers	**Register N**: High byte = month 1-12 Low byte = day 1-31 **Register N+1**: High byte = year 0-199 (+1900) Low byte = hour 0-23 **Register N+2**: High byte = minutes 0-59 Low byte = seconds 0-59	Generic	T/A:XX;m:N:u3;L:P:1
L:P:2	6 sequential registers	**Register N**: seconds 0-59 **Register N+1**: minutes 0-59 **Register N+2**: hours 0-23 **Register N+3**: day 1-31 **Register N+4**: month 1-12 **Register N+5**: year 0-199 (+1900)	Generic	T/A:XX;m:N:u6;L:P:2
L:P:3	3 or 4 sequential registers	**Register N**: High byte = month 1-12 Low byte = day 1-31 **Register N+1**: High byte = year 0-199 (+1900) Low byte = hour 0-23 **Register N+2**: High byte = minutes 0-59 Low byte = seconds 0-59 **Register N+3**: msec = 0-999 (unused)	Circuit Monitor/ Power Meter	T/A:XX;m:N:u3;L:P:3 or T/A:XX;m:N:u4;L:P:3
L:P:4	3 or 4 sequential registers	**Register N**: Bits 0-6 = year 0-70 (2000- 2070), 71-99 (1971-1999) **Register N+1**: Bits 8-11 = month Bits 0-4 = day **Register N+2**: Bits 8-11 = hour Bits 0-5 = minutes **Register N+3**: msec = 0-59,999 (seconds are ms/1000)	Sepam	T/A:XX;m:N:u3;L:P:4 or T/A:XX;m:N:u4;L:P:4
L:P:5	3 sequential registers	**Register N**: High byte = month 1-12 Low byte = day 1-31 **Register N+1**: High byte = year 0-69 (+12000), 70-99 (+1900) Low byte = hour 0-23 **Register N+2**: High byte = minutes 0-59 Low byte = seconds 0-59	Circuit Monitor/ Power Meter	T/A:XX;m:N:u3;L:P:5

Logic code	Register definition	Processing description	Device support	Example of usage
Date/time processing codes (cont.)				
L:P:6	4 sequential registers	**Register N**: High byte = month 1-12 Low byte = day 1-31 **Register N+1**: High byte = year 0-69 (+2000), 70-99 (+1900)) Low byte = hour 0-23 **Register N+2**: High byte = minutes 0-59 Low byte = seconds 0-59 **Register N+3**: msec = 0-999 (unused)	Circuit Monitor/ Power Meter	T/A:XX;m:N:u4;L:P:6
L:P:7	4 sequential registers	**Register N**: High byte = seconds 00-59 Low byte = 0 (unused) **Register N+1**: High byte = hour 00-23 Low byte = minutes 00-59 **Register N+2**: High byte = month 01-12 Low byte = day 01-31 **Register N+3**: Word = year 2006-2099 ***Note:*** *Register values are read in BCD format.*	TeSys T	T/A:XX;m:R:u4;L:P:7
L:P:8	6 sequential registers	**Register N**: year 2000-2099 **Register N+1**: month 1-12 **Register N+2**: day 1-31 **Register N+3**: hour 0-23 **Register N+4**: minutes 0-59 **Register N+5**: seconds 0-59	PXP	T/A:XX;m:R:u6;L:P:8
Modulo 10K processing codes				
L:P:10	Up to 4 sequential registers	Modulo 10K. Result is either a string or an integer representation. Range = 0-9,999,999,999,999,999 Each register has a range of 0 to 9,999. Result is: **R4*10,000^3 + R3*10,000^2 + R2*10,000 + R1**	Generic	Usually used for Energies and counts T:BC;m:R1:size;L:P:10 Size can be u1 to u4
L:P:11	Up to 4 sequential registers	Modulo 10K value. Result is either a string or an integer representation. Range = 0-9,999,999,999,999,999 Each register has a range of 0 to 9,999. Result is: **R4*10,000^3 + R3*10,000^2 + R2*10,000 + R1**	Generic	Usually used for Energies and counts T:BC;m:R1:size;L:P:11 Size can be u1 to u4
L:P:12	Up to 4 sequential registers	Modulo 10K. Result is either a string or an integer representation. Range = 0-9,999,999,999,999,999 Each register has a range of 0 to 9,999. Result is: **(R4*10,000^3 + R3*10,000^2 + R2*10,000 + R1)/1000**	Generic	Usually used for Energies and counts T:BC;m:R1:size;L:P:12 Size can be u1 to u4
L:P:13	Up to 4 sequential registers	Modulo 10K value. Result is either a string or an integer representation. Range = 0-9,999,999,999,999,999 Each register has a range of 0 to 9,999. Result is: **(R4*10,000^3 + R3*10,000^2 + R2*10,000 + R1)/1000**	Generic	Usually used for Energies and counts T:BC;m:R1:size;L:P:13 Size can be u1 to u4
Values with bitmask processing codes				
L:P:20	2 registers	First register (R1) (100-199 inclusive) indicates that this is a digital input register. Second register (R2) is bit masked to test for either ones and/or zeros. Used to get single bit status of a register. Bit position given by the bitmask. 1's bitmask checks for one in the bit position and 0's bitmask checks for zero in the bit position.	Generic	PL Digital Input SS T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:20
L:P:21	2 registers	Same as PL Digital Input SS except: ■ Inversion will invert only OFF and ON states. ■ If the register read provides a 0, it is converted to 01 = OFF. ■ If the register read provides a 1, it is converted to a 10 = ON Result is: 0 = intermediate, 1 = OFF, 2 = ON, 3 = bad-state	Generic	PL Digital Input DS T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:21
L:P:22	2 registers	Same as PL Digital Input SS except: This result can be inverted. Result is: 0 = false, 1 = true	Generic	T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:22
L:P:23	2 registers	First register (R1) (200-299 inclusive) indicates that this is a digital output register. Second register (R2) is masked to test for either one 1 or one 0. Result is: 0 = OFF and 1 = ON	Generic	PL Digital Output SS T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:23
L:P:24	2 registers	Same as PL Digital Output SS, except: ■ Inversion will invert only OFF and ON states. ■ If the register read provides a 0, it is converted to 01 = OFF. ■ If the register read provides a 1, it is converted to a 10 = ON Result is: 0 = intermediate, 1 = OFF, 2 = ON, 3 = bad-state	Generic	PL Digital Output DS T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:24
L:P:25	2 registers	Same as PL Digital Output SS except: Result is: 0 = false, 1 = true	Generic	PL Digital Output TF T:XX;m:R1;m:R2:oooo:zzzz:N/I;L:P:25

Appendix B
Processing codes

Logic code	Register definition	Processing description	Device support	Example of usage
Values with bitmask processing codes (cont.)				
L:P:26	Up to 4 registers	Each register is compared to a ones' mask. Optionally, it can also be compared to a zeros' mask. If there is only one register, the result can be inverted. Result is: 0 = OFF, 1 = ON	Generic	Status SS T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:26
L:P:27	Up to 4 registers	Same as Status SS except: ■ Inversion will invert only OFF and ON states. ■ If the register read provides a 0, it is converted to 01 = OFF. ■ If the register read provides a 1, it is converted to a 10 = ON Result is: 0 = intermediate, 1 = OFF, 2 = ON, 3 = bad-state	Generic	Status DS T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:27
L:P:28	Up to 4 registers	Same as Status SS except: This result can be inverted.	Generic	Status TF T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:28
L:P:29	1 register	One register is bit ANDed with one mask. The result is an integer that can be used to choose the appropriate enumeration.	Generic	Status Integer T:XX;m:R1:oooo;L:P:29
L:P:226	2 to 4 registers	Each register is compared to a ones' mask. These results are ORed together. Optionally, it can also be compared to a zeros' mask. This result can be inverted. For inversion, only one bit can be tested, using either the ones or the zeros mask. To use only the zeros mask, a ones mask of 0 must be used as a place holder. Result is: 0 = OFF and 1 = ON	Generic	Status OR SS T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:226
L:P:227	2 to 4 registers	Same as Status OR SS except: Result is: 0 = intermediate, 1 = OFF, 2 = ON, 3 = bad-state	Generic	Status OR DS T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:227
L:P:228	2 to 4 registers	Same as Status OR SS except: Result is: 0 = false, 1 = true	Generic	Status OR TF T:XX;m:R1:oooo:zzzz; m:R2:oooo:zzzz:N/ I;L:P:228
L:P:229	Up to 4 registers	Each register is evaluated against its mask. Individual results are all 0 or 1... false or true... then the results are added together like this result for R1 * 2^0 + result for R2 * 2^1 + result for R3 * 2^2 + result for R4 * 2^3	Generic	Status Enumeration T:XX;m:R1:oooo;m:R2: oooo; m:R3:oooo;m:R4:oooo; L:P:229
Scaled registers processing codes				
L:P:30	3 registers	First register (R1) (300-399 inclusive) indicates that this is a analog input register. Second register (R2) is treated as a signed value. Third register (R3) can contain a value from -3 to 3 and will be used to scale the second register (R2*10^R3).	Generic	T/ A:XX;m:R1:u1;m:R2:u1 ;m:R3:u1;L:P:30
L:P:31	2 registers	First register (R1) (400-499 inclusive) indicates that this is a analog output register. Second register (R2) is treated as a signed value.	Generic	T/ A:XX;m:R1:u1;m:R2:u1 ;L:P:31
L:P:32	1 or 2 sequential registers	For a single register: treated as a signed value from -32,767 to +32,767. (-32768 will result in a NA) For two registers: the registers will be concatenated together, the first register filling bits 16-32 and the second register filling bits 0-15. Values will range from -2,147,483,648 to -2,147,483,647. Values can be scaled using a fixed scale or a scale register.	Generic	T/A:XX;m:R1:u1;L:P:32 Or T/A:XX;m:R1:u2;L:P:32 Or T/A:XX;m:R1:u1; m:R2 :u1; m:R3:u1;m:R4:u1;L:P:3 2(only for Sepam 2000)
L:P:33	1 or 2 sequential registers	For a single register: treated as an unsigned value from 0 to 65,535. For two registers: the registers will be concatenated together, the first register filling bits 16-32 and the second register filling bits 0-15. Values will range from 0 to 4,294,967,295. Values can be scaled using a fixed scale or a scale register For Sepam, value 0x7FFF is Invalid	Generic	T/A:XX;m:R1:u1;L:P:33 Or T/A:XX;m:R1:u2;L:P:33 Or T/A:XX;m:R1:u1; m:R2 :u1; m:R3:u1;m:R4:u1;L:P:3 3(only for Sepam 2000)
L:P:34	1 or 2 sequential registers	Same as Scaled Register except that a single register with value -32768 is acceptable and will be reported as such.	Generic	T/A:XX;m:R1:u1;L:P:34 Or T/A:XX;m:R1:u2;L:P:34
L:P:35	2 sequential registers	Same as Scaled Register except that 0xFFFFFFFF or 0x00007FFF will be NA.	Generic	T/A:XX;m:R1:u2;L:P:35
L:P:36	2 sequential registers	Same as Scaled Register except that 0xFFFFFFFF will be NA.	Generic	T/A:XX;m:R1:u2;L:P:36
L:P:37	2 sequential registers	Uses the IEEE standard for floating-point arithmetic. (IEEE 754)	Generic	T/A:XX;m:R1:u2;L:P:37
Strings processing codes				
L:P:39	1 or 2 sequential registers	Each register can represent up to two ASCII characters.	Generic	PL String T/ A:XX;m:R1:u10;L:P:39

Appendix B
Processing codes

Logic code	Register definition	Processing description	Device support	Example of usage
Math processing codes				
L:P:40	1 to 4 registers	Result is: R1 + … + Rn * 10^scale All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Sum of registers T:XX;m:R1:u1;m:R2:u1; m:R3:u1;L:P:40
L:P:41	2 or 3 registers	Result is: R1/R2 * R3 * 10^scale R3 is optional All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Divide registers T:XX;m:R1:u1;m:R2:u1; m:R3:u1;L:P:41
L:P:42	1 to 4 registers	Result is: R1 * … * Rn * 10^scale All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Multiply registers T:XX;m:R1:u1;m:R2:u1; R:Address;L:P:42
L:P:43	1 to 4 registers	Result is: Avg(R1 … Rn) * 10^scale All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Average registers T:XX;m:R1:u1;m:R2:u1; m:R3:u1;L:P:43
L:P:44	2 to 4 registers	Result is: Avg(R1 … Rn-1) * Rn * 10^scale All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Average registers WF T:XX;m:R1:u1;m:R2:u1; m:R3:u1;L:P:44
L:P:45	2 registers	Result is: (R1 * 10^scale) + R2 All registers are assumed to contain a signed value unless indicated by a format specifier such as 32U, or u1	Generic	Sum with scaled registers T:XX;m:R1:u1;m:R2:u1; N:value;L:P:45
L:P:46	2 registers	Result is same as above, except unsigned. All registers are assumed to contain a signed value unless indicated explicitly by a format specifier such as 32U, or u1	Generic	Sum with scaled registers unsigned T:XX;m:R1:u1;m:R2:u1; N:value;L:P:46
Power factor processing codes				
L:P:50	1 register	Returns IEEE power factor	Circuit Monitor	T:XX;m:R1:u1;L:P:50
L:P:51	2 registers	Returns the IEEE power factor (converted from IEC mode as necessary). First register contains IEEE PF, the second register contains IEC PF. The device may be in IEEE or IEC mode if the device firmware version is 11.5 or higher. If the device firmware version is below 11.5, IEC mode is not supported. 2 additional registers must be read to determine which register to read.	Power Meter	T:XX;m:R1:u1; m:R2:u1;L:P:51
L:P:52	1 register	Returns the IEEE power factor (converted from IEC mode).	Sepam	T:XX;m:R1:u1;L:P:52
L:P:53	2 registers	Returns the IEEE power factor (converted from IEC mode as necessary). The second input register must be the associated Reactive Power for the Power Factor requested.	Micrologic	T:XX;m:R1:u1; m:R2:u1;L:P:53
L:P:54	2 registers	First register (R1) reads the magnitude of the power factor. Second register (R2) reads the sign of the power factor.	PXP	TA:XX;m:R1:u1;m:R2:o ooo;L:P:54
Unique situations processing codes				
L:P:300		Reserved for future implementation.		
L:P:301	Up to 3 registers	Used to process 'health' of devices.The response is of Integer Status type with values: 1=Ok 2=Warning 3=Alarm ■ For devices with a map for 'health': if (if any channel is ON) then value = 3 else value = 1 (value 2 is not used) ■ For the G3200 and other devices without a map for 'health' value = 1	Generic	
L:P:302	None	Default response for Mandatory data objects when no data exists on a device. Returns the following: return the value = 0 set Quality attribute: validity = 'invalid' detail Quality = 'bad Reference' for Timestamp attribute: Device should return time if it can or set Timestamp attribute as follows: in Time Quality, set Clock Failure = TRUE	Generic	T:XX;L:P:302

Logic code	Register definition	Processing description	Device support	Example of usage
Unique situations processing codes (cont.)				
L:P:303	Up to 3 registers	Used to process 'physical health' of the device Register allocation and interpretation is implementation specific. The response is of Integer Status type with values: 1=Ok 2=Warning 3=Alarm An example implementation is shown below: ■ For PowerLogic G3200: value = 1 ■ For other devices: If (communication with device is On-line) then value = 1 else value = 3	Generic	
L:P:304	None	Used to process 'proxy' Data. The response is of Integer Status type: if logical device is PowerLogic G3200 then value = FALSE else value = TRUE (case of all other devices)	Generic	
L:P:305	0 or 1 registers	Used to process 'Mod' Data. Register allocation and interpretation is implementation specific. The response is of Integer Status type with values: 1=on 2=blocked 3=test 4=test/blocked 5=off > An example implementation is shown below: ■ For PowerLogic G3200: value = 1 ■ For other devices: if (communication with device is On-line) then value = 1 else value = 5 (values 2, 3 and 4 are not used)	Generic	
L:P:306	1 register	Use to process 'temperature' Data as follows: if (|value returned by Sepam| > 300) then return the value = 0 set Quality attribute: validity = 'invalid' detailQuality = 'failure' This function takes precedence over the dead band, db	Sepam	T:XX;m:R1;L:P:306
L:P:307	1 register	if(0) result = 60Hz Else if(1) result = 50Hz	ION	T:XX;m:R1;L:P:307

L:P:308	1 register	if (bit3) result = 400 Hz
		If(bit2) result = 60Hz
		If(bit1) result = 50Hz
			Micrologic	T:XX;m:R1;L:P:308

L:P:309	1 register	register is compared to a ones' mask.
		If(1) result = ON (1)
		If(0) result = OFF (5)
			Micrologic	T:XX;m:R1:oooo;L:P:309

L:P:310	2 to 4 registers	Same as tbds, but up to 4 registers is compared to respective ones' masks then ANDed.
		If(1) result = ON (1)
		If(0) result = OFF (5)
			Micrologic	T:XX;m:R1:oooo;
				m:R1:oooo;L:P:310

L:P:312	1 register	If(1) result = 5 (OFF)
		If(2) result = 1 (ON)
		If(4) result = 3 (TEST)
			Micrologic	T:XX;m:R1;L:P:312

Write processing codes				
L:P:101 Status Write Register	1 register	If the value written to the tag = 1, the tag writes the MASK value to the register. If the tag is read, it checks that the mask is EQUAL to the register (if it is, then value = TRUE, else value = FALSE).	Generic	Write example T:SS;m:20:C0;L:P:101 starting reg 01010000 mask 11000000 ending reg 11000000
L:P:102 Status Write Register AND	1 register	If the value written to the tag = 1, the tag reads the register AND the value with the bitwise complement of the MASK, and then writes the result back to the register. If the tag is read, it checks that the register has a 1 everywhere the mask has a 1 (if it does, then value = TRUE, else value = FALSE).	Generic	Write example T:SS;m:20:C0;L:P:102 starting reg 01010000 mask 11000000 ending reg 00010000
L:P:103 Status Write Register OR	1 register	If the value written to the tag = 1, the tag reads the register OR the value with the MASK, and then writes the result back to the register. If the tag is read, it checks that the register has a 0 everywhere the mask has a 0 (if it does, then value = TRUE, else value = FALSE).	Generic	Write example T:SS;m:20:C0;L:P:103 starting reg 01010000 mask 11000000 ending reg 11010000

Appendix C
Modelling examples

This appendix contains the following examples of individual mapping strings in different cases:

- Modelling of analog measure variable
- Example of a complex measure variable
- Example of energy counter
- Example of device time stamp with attribute mapping
- Example of single status with 1's bitmask
- Example of single status with 0's bit mask
- Example of single status with 0's and 1's bitmask
- Example of DS breaker position
- Example of IO
- Example of alarm in Micrologic
- Example of control points (coils)
- Example of common logical node data
- Example of NA (no mapping)
- Example of math operation
- Example of bit string
- Example of strings

Modelling of analog measure variable

phsA current is available in Modbus register 1100 and its scaling information is available in register 3209.

- Type for measure is T:MV;
- Register description:
  - Holding register is m:
  - address is 1100:
  - size is u1;
  - scale is R:3209; (no boundary check)
- Processing code is L:P:32

Map would look like T:MV;m:1100:u1;R:3209;L:P:32

```
<LN desc="Measurements" inst="1" lnClass="MMXU" lnType="SE_MMXU_PM8_V001" prefix="">
  <DOI name="A">
    <SDI name="phsA">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:1100:u1;R:3209;L:P:32</Private>
      <DAI desc="unit: 1A" name="db" valKind="Set">
        <Val>1</Val>
      </DAI>
    </SDI>
  </DOI>
</LN>
```

Appendix C
Modelling examples

Example of a complex measure variable

For modelling complex measure variable of the phase C current, the IEC tag is: MMXU1\A\phsC

phsC is a complex measure value, it has both magnitude and angle mapped to two different Modbus registers. Magnitude is available in Modbus register 1234 and its scaling information available in register 3209. Angle of the current is available in 1235 and its scaling factor is 0.1.

- Type for Complex measure is T:CM;
- Register description1:
  - Holding register is m:
  - address is1234:
  - size is u1;
  - scale is R:3209; (no boundary check)
- Register description2:
  - Holding register is m:
  - address is1235:
  - size is u1;
  - scale is N:-1; (no boundary check)
- Processing code is L:P:32

Map would look like T:CM;m:1234:u1;R:3209;m:1235:u1;N:-1;L:P:32

```
<LN desc="Measurements" inst="1" lnClass="MMXU" lnType="SE_MMXU_PM8_V001" prefix="">
 <DOI name="A">
  <SDI name="phsC">
     <Private type="SchneiderElectric-IED-PntRef">T:CM;m:1234:u1;R:3209;m:1235:u1;N:-1;L:P:32
      </Private>
     <DAI desc="1A" name="db" valKind="Set">
       <Val>1</Val>
     </DAI>
  </SDI>
 </DOI>
</LN>
```

Example of energy counter

For modelling Energy counter variables, the IEC tag is: MMTR1\SupWh

SupWh is available from 4 consecutive Modbus registers starting from 1708 and the value is represented in kWh.

- Type for Energy counter is BCR, T:BC;
- Register description:
  - Holding register is m:
  - address is1708:
  - size is u4;
  - no scale
- unit is KWh. Processing code is L:P:13

Map would look like T:BC; m:1708:u4;L:P:13

```
<LN desc="Energy counters" inst="1" lnClass="MMTR" lnType="SE_MMTR_PM8_V001" prefix="">
  <DOI name="SupWh">
     <Private type="SchneiderElectric-IED-PntRef">T:BC;m:1708:u4;L:P:13</Private>
  </DOI>
</LN>
```

Example of device time stamp with attribute mapping

Maximum imbalance voltage is available in register 1348, its scale is 0.1 and time of occurrence is available in the three registers following from1345.

- Type for measure is T:MV;
- Register description:
  - Holding register is m:
  - address is1348:
  - size is u1;
  - Scale is N:-1 (no boundary check)
- Processing code is L:P:32

Map for maximum imbalance voltage is T:MV;m:1348:u1;N:-1;L:P:32

Time occurrence is associated with maximum imbalance voltage, it is mapped at the attribute level.

- Type for Time at attribute level is A:TS;
- Register description:
  - Holding register is m:
  - address is1345:
  - size is u3;
- Processing code is L:P:1

Map would look like A:TS;m:1345:u3;L:P:1

```
<DOI name="MaxImbV">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:1348:u1;N:-1;L:P:32</Private>
      <DAI name="t">
         <Private type="SchneiderElectric-IED-PntRef">A:TS;m:1345:u3;L:P:1</Private>
      </DAI>
</DOI>
```

Example of single status with 1’s bitmask

1's bitmask checks the 1 in the selected bit position.

To set the trip unit door status of Micrologic 9th bit of 8743 to one, map using the 1's bitmask.

- Type for single status is T:SS;
- Register description:
  - Holding register is m:
  - address is 8743:
  - ones bitmask is 200 (mask for 9th bit in hexadecimal)
- Processing code is L:P:26

Map would look like T:SS;m:8743:200;L:P:26

```
<DOI name="ZTrUnitDrSt">
       <Private type="SchneiderElectric-IED-PntRef">T:SS;m:8743:200;L:P:26</Private>
</DOI>
```

Example of single status with 0’s bitmask

0's bitmask checks the 0 in the selected bit position.

To set the Block open status of Micrologic 1st and 3rd bits of register 669 to zero, map using 0's bitmask.

- Type for single status is T:SS;
- Register description:
  - Holding register is m:
  - address is 669:
  - ones bitmask is 0:
  - zeros bitmask is A; (mask for 1st and 3rd bits in hexadecimal)
- Processing code is L:P:26

Map would look like T:SS;m:669:0:A;L:P:26

```
<DOI name="BlkOpn">
    <Private type="SchneiderElectric-IED-PntRef">T:SS;m:669:0:A;L:P:26</Private>
</DOI>
```

Appendix C
Modelling examples

Example of single status with 0’s and 1’s bitmask

1's bitmask checks the 1 in the selected bit position and 0's bitmask checks the 0 in the selected bit position.

To set the X status of a device 2nd bit of register 669 to one and 1st and 3rd bits of register 669 to zero, use both 1's and 0's bitmasks.

- Type for single status is T:SS;
- Register description:
  - Holding register is m:
  - address is 669:
  - ones bitmask is 2: (mask for 2nd bit in hexadecimal)
  - zeros bitmask is A; (mask for 1st and 3rd bits in hexadecimal)
- Processing code is L:P:26

Map would look like T:SS;m:669:2:A;L:P:26

```
<DOI name="X">
 <Private type="SchneiderElectric-IED-PntRef">T:SS;m:669:2:A;L:P:26</Private>
</DOI>
```

Example of DS breaker position

Breaker Position status is a double point status and can have four different modes.

When the breaker position is mapped to 0th bit of the register 661 and the bit is 0, breaker is in OFF state; if the bit is 1, breaker is in ON state.

- Type for Double status is T:DS;
- Register description:
  - Holding register is m:
  - address is 661:
  - ones bitmask is 1: (mask for 1st bit in hexadecimal)
- Processing code is L:P:27

Map looks like T:DS;m:661:1;L:P:27

```
<DOI name="Pos">
  < Private type="SchneiderElectric-IED-PntRef">T:DS;m:661:1;L:P:27</Private>
</DOI>
```

Example of I/O

The I/O type (analog or digital) must be known to map I/Os.
Mapping Standard Discrete Output I/O point with base address 4300 and status of "LocKey" is given by 0th bit of 4312.

- Type for single status is T:SS;
- Register description1:
  - Holding register is m:
  - address is 4300:
- Register description2:
  - Holding register is m:
  - address is 4312:
  - ones bitmask is 1; (mask for 1st bit in hexadecimal)
- Processing code for Digital output SS is L:P:23

Map would look like T:SS; m:4300;m:4312:1;L:P:23

```
<LN desc="General IO" inst="1" lnClass="GGIO" lnType="SE_GGIO_PM8_V001" prefix="">
  <DOI name="ZMtrDPC1">
    <SDI name="LocKey">
      <Private type="SchneiderElectric-IED-PntRef">T:SS;m:4300;m:4312:1;L:P:23</Private>
    </SDI>
  </DOI>
</LN>
```

Mapping Standard Discrete Input I/O point with base address 4300 and status of "Ind" is given by 0th bit of 4355.

- Type for single status is T:SS;
- Register description1:
  - Holding register is m:
  - address is 4300:
- Register description2:
  - Holding register is m:
  - address is 4355:
  - ones bitmask is 1; (mask for 1st bit in hexadecimal)
- Processing code for Digital input SS is L:P:20

Map would look like T:SS; m:4330;m:4355:1;L:P:20

```
< LN desc ="General IO" inst="1" lnClass="GGIO" lnType="SE_GGIO_PM8_V001" prefix="">
  <DOI name= ZMtrInd1">
    < SDI name="Ind">
      <Private type="SchneiderElectric IED PntRef">T:SS;m:4330;m:4355:1;L:P:20</Private>
    </SDI>
  </DOI>
</LN >
```

Example of alarm in Micrologic

Mapping of over current alarm is retrieved from the file 20, its alarm number is 1017 and its alarm type is 1(over).

- Type for Alarm is T:ALM;
- Alarm description:
  - file number is F:20;
  - alarm number is q:1017:
  - alarm type is1

Map would look like T:ALM;F:20; q:1017:1

```
<LN desc="" inst="1" lnClass="PTOC" lnType="SE_PTOC_Micrologic_V001" prefix="">
  <DOI name="Op">
     <Private type="SchneiderElectric-IED-PntRef">T:ALM;F:20;q:1017:1</Private>
  </DOI>
</LN>
```

Appendix C
Modelling examples

Example of control point (coils)

Control points are used to control by setting or clearing a flag in the register.
For example, Control coil C883 is used to Reset the Maximum currents.

- Type for Single point control, control only is T:SN;
- Register description:
  - Coil register is C:
  - address is C883:

Map would look like T:SN;C:C883

```
<DOI name="RsMaxA">
     <Private type="SchneiderElectric-IED-PntRef">T:SN;C:C883</Private>
</DOI>
```

Example of common logical node

Mandatory common logical node data are "Mod", "Beh", "Health" and "Nameplate".
For example, "Mod" of a logical node is available with a status coil register C9CF.

- Type for Integer Status control, control only is T:IO;
- Register description:
  - Status register is S:
  - address is C9CF:
- Processing code for 'Mod' for LLN0 is L:P:305

Map would look like T:IO;S:C9CF;L:P:305

```
<DOI name="Mod">
  <Private type="SchneiderElectric IED PntRef"> T:IO;S:C9CF;L:P:305</Private>
</DOI>
```

Example NA (no mapping)

Default response for Mandatory data objects when no data exists on a device can be mapped using L:P:302.
For example, under PTUV logical node both "Str" and "Op" are mandatory data objects. If no data exists on a device, "Str" can be mapped.

- Str(Start) is Activation Directional, Type for Activation Directional, T:AD
- No data exists on a device so no register description exists.
- Processing code for No data objects is L:P:302

Map would look like T:AD;L:P:302

```
<DOI name="Str">
   <Private type="SchneiderElectric-IED-PntRef">T:AD;L:P:302</Private>
</DOI>
```

Example of math processing

In some cases, to obtain a value requires some mathematical calculation on the values of different Modbus registers. This is mapped by using Math processing L:P codes. For example, pulse weight of discrete Input I/O available in register 4347 and its scaling information available in 4348.

- Pulse weight is measured value, Type for measure is T:MV;
- Register description:
  - Holding register is m:
  - address is 4347:
  - size is u1;
  - scale is R:4348 (no boundary check)
- Processing code for multiply math operation is L:P:42

Map would look like T:MV;m:4347:u1;R:4348; L:P:42

```
<SDI name="X">
   <Private type="SchneiderElectric-IED-PntRef">T:MV;m:4347:u1;m:4348:u1;R:4349;L:P:42
   </Private>
</SDI>
```

Appendix C
Modelling examples

Example of bit string

Circuit breaker racked out depends on the various bits of a register 661. The status is given by all these bit strings.

- Type for status enumeration isT:EN;
- Register description1:
  - Holding register is m:
  - address is 661:
  - ones bitmask is100; (mask for 8th bit in hexadecimal)
- Register description2:
  - Holding register is m:
  - address is 661:
  - ones bitmask is 400; (mask for 10th bit in hexadecimal)
- Register description3:
  - Holding register is m:
  - address is 661:
  - ones bitmask is 0;
  - zeros bitmask is 700; (mask for 8-10 bit in hexadecimal)
- Processing code for status enumeration is L:P:229

Map would look like T:EN;m:661:100:0;m:661:400:0;m:661:0:700;L:P:229

```
<DOI name="CBRkdPos">
 <Private type="SchneiderElectric-IED-PntRef">T:EN;m:661:100:0;m:661:400:0;m:661:0:700;L:P:229
 </Private>
</DOI>
```

Example of strings

A label of general input output port is available in 8 registers from 4331.

- Type for strings is T:ST;
- Register description:
  - Holding register is m:
  - address is 4331:
  - size is u8;
- Processing code strings is L:P:39

Map would look like T:ST;m:4331:u8;L:P:39

```
<SDI name "zlbl">
   <Private type="SchneiderElectric IED-PntRef >T:ST;m:4331:u8;L:P:39</Private>
</SDI>
```

Example 1: LDevice section of ION7650 ICD file

```
<LDevice desc="IONMeter" inst="LD0">
<!-- ============================================================================
            DEVICE CHARACTERISTICS
          ============================================================================ -->
          <Private type="SchneiderElectric-SFT-IcdFileName">SE_ION_7650-
            F01_E1V01.icd</Private>
          <Private type="SchneiderElectric-SFT-IedVersion">500</Private>
          <Private type="SchneiderElectric-SFT-IedName">IONMeter</Private>
          <Private type="SchneiderElectric-SFT-IedFamily">ION7650</Private>
          <Private type="SchneiderElectric-SFT-IedAppli">IONMeter</Private>
          <Private type="SchneiderElectric-IED-DevModel">7650:ION7650</Private>
          <Private type="SchneiderElectric-IED-MdbAddr">1</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">96:ED:M</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">106:115:M</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">112C:112C:M</Private>
          <LN0 desc="General" inst="" lnClass="LLN0" lnType="SE_LLN0_IONMeter_V001">
            <DataSet desc="Default status reporting dataset" name="StDs">
              <FCDA doName="DmdVArh" fc="ST" ldInst="LD0" lnClass="MMTR" lnInst="1"
                prefix=""/>
              <FCDA doName="DmdWh" fc="ST" ldInst="LD0" lnClass="MMTR" lnInst="1" prefix=""/>
              <FCDA doName="SupVArh" fc="ST" ldInst="LD0" lnClass="MMTR" lnInst="1"
                prefix=""/>
              <FCDA doName="SupWh" fc="ST" ldInst="LD0" lnClass="MMTR" lnInst="1" prefix=""/>
            </DataSet>
            <DataSet desc="Default measurands reporting dataset" name="MxDs">
              <FCDA doName="A" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="Hz" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="PF" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="PhV" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="TotPF" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
               <FCDA doName="TotVAr" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1"
                prefix=""/>
              <FCDA doName="TotW" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="VAr" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
              <FCDA doName="W" fc="MX" ldInst="LD0" lnClass="MMXU" lnInst="1" prefix=""/>
            </DataSet>
            <ReportControl bufTime="100" buffered="true" confRev="1" datSet="StDs"
                desc="Default Status Report" intgPd="0" name="brcbST01" rptID="StRpt">
              <TrgOps dchg="true" dupd="false" period="true" qchg="true"/>
              <OptFields bufOvfl="false" configRef="true" dataRef="true" dataSet="true"
                entryID="true" reasonCode="true" segmentation="false" seqNum="true"
                timeStamp="true"/>
            </ReportControl>
            <ReportControl bufTime="500" buffered="true" confRev="1" datSet="MxDs"
                desc="Default Status Report" intgPd="0" name="brcbMX01" rptID="MxRpt">
              <TrgOps dchg="true" dupd="false" period="true" qchg="true"/>
              <OptFields bufOvfl="false" configRef="true" dataRef="true" dataSet="true"
                 entryID="true" reasonCode="true" segmentation="false" seqNum="true"
                 timeStamp="true"/>
            </ReportControl>
            <DOI name="Mod">
              <Private type="SchneiderElectric-IED-PntRef">T:IO;L:P:305</Private>
            </DOI>
          </LN0>
          <LN desc="Device" inst="1" lnClass="LPHD" lnType="SE_LPHD_IONMeter_V001" prefix="">
            <DOI name="PhyNam">
              <DAI name="model" valKind="Set">
                <Val>ION7650</Val>
              </DAI>
              <DAI desc="can be freely used" name="location" valKind="Set">
                <Val>location</Val>
              </DAI>
            </DOI>
            <DOI name="PhyHealth">
              <Private type="SchneiderElectric-IED-PntRef">T:IO;L:P:303</Private>
            </DOI>
            <DOI name="Proxy">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;L:P:304</Private>
            </DOI>
          </LN>
```

Example 1: LDevice section of ION7650 ICD file (cont.)

```
<LN desc="Energy counters" inst="1" lnClass="MMTR" lnType="SE_MMTR_IONMeter_V001" prefix="">
    <DOI name="DmdVArh">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:236:s2;L:P:32</Private>
    </DOI>
    <DOI name="DmdWh">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:232:s2;L:P:32</Private>
    </DOI>
    <DOI name="SupVArh">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:234:s2;L:P:32</Private>
    </DOI>
    <DOI name="SupWh">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:230:s2;L:P:32</Private>
    </DOI>
</LN>

<LN desc="Measurements" inst="1" lnClass="MMXU" lnType="SE_MMXU_IONMeter_V001" prefix="">
    <DOI name="A">
      <SDI name="phsA">
        <Privatetype="SchneiderElectric-IED-PntRef">T:MV;m:150:u1;N:-1;L:P:33</Private>
          <DAI desc="unit: 1A" name="db" valKind="Set">
           <Val>1</Val>
           <DAI>
      </SDI>
      <SDI name="phsB">
      </SDI>
      <SDI name="phsC">
      </SDI>
    </DOI>
    <DOI name="Hz">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:159:u1;N:-1;L:P:33</Private>
        <DAI desc="unit: 0.1Hz" name="db" valKind="Set">
          <Val>1</Val>
        </DAI>
    </DOI>
    <DOI name="PF">
      <SDI name="phsA">
        <Private type="SchneiderElectric-IED-PntRef"> T:MV;m:262:s1;N:-4;L:P:32</Private>
          <DAI desc="unit: 0.001" name="db" valKind="Set">
            <Val>1</Val>
          </DAI>
      </SDI>
      <SDI name="phsB">
                ...
      </SDI>
      <SDI name="phsC">
                ...
      </SDI>
    </DOI>
    <DOI name="PhV">
      <SDI name="phsA">
        <Private type="SchneiderElectric-IED-PntRef">T:MV;m:166:u2;L:P:33</Private>
        <DAI desc="unit:1V" name="db" valKind="Set">
          <Val>1</Val>
        </DAI>
      </SDI>
      <SDI name="phsB">

      </SDI>
      <SDI name="phsC">

      </SDI>
    </DOI>
    <DOI name="TotPF">
      <Private type="SchneiderElectric-IED-PntRef">T:MV;m:265:s1;N:-4;L:P:32</Private>
      <DAI desc="unit: 0.001" name="db" valKind="Set">
        <Val>1</Val>
      </DAI>
    </DOI>
```

Example 1: LDevice section of ION7650 ICD file (cont.)

```
<DOI name="TotVA">
              <Private type="SchneiderElectric-IED-PntRef">T:MV;m:224:s2;L:P:32</Private>
              <DAI desc="unit: 0.1KVA" name="db" valKind="Set">
                <Val>1</Val>
              </DAI>
            </DOI>
            <DOI name="TotVAr">
                              …
            </DOI>
            <DOI name="TotW">
                              …
            </DOI>

            <DOI name="VAr">
              <SDI name="phsA">
                <Private type="SchneiderElectric-IED-PntRef">T:MV;m:208:s2;L:P:32</Private>
                <DAI desc="unit: 0.01KVAr" name="db" valKind="Set">
                  <Val>1</Val>
                </DAI>
              </SDI>
              <SDI name="phsB">
                              …
              </SDI>
              <SDI name="phsC">
                              …
            </DOI>
            <DOI name="W">
              <SDI name="phsA">
                <Private type="SchneiderElectric-IED-PntRef">T:MV;m:198:s2;L:P:32</Private>
                <DAI desc="unit: 0.01KW" name="db" valKind="Set">
                  <Val>1</Val>
                </DAI>
              </SDI>
              <SDI name="phsB">
                              …
              </SDI>
              <SDI name="phsC">
                              …
              </SDI>
            </DOI>
          </LN>
        </LDevice>
```

Example 2: LDevice section of Easergy-T200I ICD file

```
<LDevice desc="EasergyT200I" inst="LD0">
<!-- ============================================================================
                                    DEVICE CHARACTERISTICS
     ============================================================================ -->
          <Private type="SchneiderElectric-SFT-IcdFileName">SE_Easergy_T200I-
F01_E1V01.icd</Private>
          <Private type="SchneiderElectric-SFT-IedVersion">0</Private>
          <Private type="SchneiderElectric-SFT-IedName">T200I</Private>
          <Private type="SchneiderElectric-SFT-IedFamily">T200  series I</Private>
          <Private type="SchneiderElectric-SFT-IedAppli">T200</Private>
          <Private type="SchneiderElectric-IED-DevModel">T200:T200</Private>
          <Private type="SchneiderElectric-IED-MdbAddr">5</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">34:36:S</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">38:3F:S</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">40:4F:M</Private>
          <Private type="SchneiderElectric-IED-MdbTbl">30:32:C</Private>
<!-- ============================================================================
                                    SYSTEM LOGICAL NODES
============================================================================ -->
          <LN0 desc="General" inst="" lnClass="LLN0" lnType="SE_LLN0_T200I_V001">
            <DataSet desc="Default Status Dataset" name="StDs">
              <FCDA doName="Loc" fc="ST" ldInst="LD01" lnClass="LLN0"/>
              <FCDA doName="PhyHealth" fc="ST" ldInst="LD01" lnClass="LPHD" lnInst="1"
               prefix=""/>
              <FCDA doName="PwrDn" fc="ST" ldInst="LD01" lnClass="LPHD" lnInst="1" prefix=""/>
              <FCDA doName="TestRsl" fc="ST" ldInst="LD01" lnClass="ZBAT" lnInst="1"
               prefix=""/>
              <FCDA doName="Loc" fc="ST" ldInst="LD01" lnClass="CSWI" lnInst="1" prefix=""/>
              <FCDA doName="Pos" fc="ST" ldInst="LD01" lnClass="CSWI" lnInst="1" prefix=""/>
              <FCDA doName="DPCSO1" fc="ST" ldInst="LD01" lnClass="GAPC" lnInst="1"
               prefix=""/>
              <FCDA doName="Ind1" fc="ST" ldInst="LD01" lnClass="GGIO" lnInst="1" prefix=""/>
              <FCDA doName="Op" fc="ST" ldInst="LD01" lnClass="SMVP" lnInst="1" prefix=""/>
              <FCDA doName="Op" fc="ST" ldInst="LD01" lnClass="SFOC" lnInst="1"
               prefix="SPh_"/>
              <FCDA doName="RsFltSt" fc="ST" ldInst="LD01" lnClass="SFOC" lnInst="1"
               prefix="SPh_"/>
              <FCDA doName="Op" fc="ST" ldInst="LD01" lnClass="SFOC" lnInst="2"
               prefix="SEF_"/>
              <FCDA doName="RsFltSt" fc="ST" ldInst="LD01" lnClass="SFOC" lnInst="2"
               prefix="SEF_"/>
              <FCDA doName="Health" fc="ST" ldInst="LD01" lnClass="ZBTC" lnInst="1"
               prefix=""/>
            </DataSet>
            <DataSet desc="Default Measurands Dataset" name="MxDs">
              <FCDA doName="zAvMes" fc="MX" ldInst="LD01" lnClass="MMXU" lnInst="1"/>
            </DataSet>
            <ReportControl bufTime="100" buffered="true" confRev="1" datSet="StDs"
             desc="Default Status Report" name="brcbST01" rptID="StReport">
              <TrgOps dchg="true" period="true" qchg="true"/>
              <OptFields configRef="true" dataRef="true" dataSet="true" entryID="true"
               reasonCode="true" seqNum="true" timeStamp="true"/>
            </ReportControl>
            <ReportControl bufTime="500" buffered="true" confRev="1" datSet="MxDs"
             desc="Default Measurands Report" name="brcbMX01" rptID="MxReport">
              <TrgOps dchg="true" period="true" qchg="true"/>
              <OptFields configRef="true" dataRef="true" dataSet="true" entryID="true"
               reasonCode="true" seqNum="true" timeStamp="true"/>
            </ReportControl>
            <DOI name="Loc">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:918</Private>
            </DOI>
            <DOI name="Mod">
              <Private type="SchneiderElectric-IED-PntRef">T:IO;L:P:305</Private>
            </DOI>
          </LN0>
```

Example 2: LDevice section of Easergy-T200I ICD file (cont.)

```
<LN desc="Device" inst="1" lnClass="LPHD" lnType="SE_LPHD_T200I_V001" prefix="">
            <DOI name="PhyNam">
              <DAI name="model" valKind="Set">
                <Val>T200I</Val>
              </DAI>
              <DAI desc="can be freely used" name="location">
                <Val/>
              </DAI>
            </DOI>
            <DOI name="PhyHealth">
              <Private type="SchneiderElectric-IED-PntRef">T:ES;s:923;L:P:303</Private>
            </DOI>
 <!--Motorization power supply failure  -->
            <DOI name="PwrDn">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:919</Private>
            </DOI>
 <!-- Immediate AC power supply defect  -->
            <DOI name="Proxy">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;L:P:304</Private>
            </DOI>
 <!-- The L:P:304 is a processing code that causes the gateway to return TRUE if the LPHD
 belongs to one of the devices attached to the G3200  -->
            <DOI name="ZPwrDnDel">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:924</Private>
            </DOI>
 <!-- Time-delayed AC power supply defect -->
          </LN>
          <LN inst="1" lnClass="ZBAT" lnType="SE_ZBAT_T200I_V001" prefix="">
            <DOI name="TestRsl">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:922:I</Private>
            </DOI>
 <!-- T200 has single status but in the standard this field is enumeration. The function will
 be described later -->
            <DOI name="Vol">
              <Private type="SchneiderElectric-IED-PntRef">T:MV;L:P:302</Private>
            </DOI>
 <!-- external battery voltage -->
          </LN>
          <LN desc="Device" inst="1" lnClass="CSWI" lnType="SE_CSWI_T200I_V001" prefix="">
            <DOI name="Loc">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:918</Private>
            </DOI>
            <DOI name="Pos">
              <Private type="SchneiderElectric-IED-PntRef">
               T:DC;c:769;c:768;s:833;s:832</Private >
            </DOI>
          </LN>
          <LN desc="Device" inst="1" lnClass="XSWI" lnType="SE_XSWIEx1_T200I_V001"
            prefix="DCNT_">
            <DOI name="BlkCls">
              <Private type="SchneiderElectric-IED-PntRef">T:SC;L:P:302</Private>
            </DOI>
            <DOI name="BlkOpn">
              <Private type="SchneiderElectric-IED-PntRef">T:SC;L:P:302</Private>
            </DOI>
            <DOI name="Loc">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;s:904</Private>
            </DOI>
            <DOI name="LocKey">
              <Private type="SchneiderElectric-IED-PntRef">T:SS;L:P:302</Private>
            </DOI>
            <DOI name="OpCnt">
              <Private type="SchneiderElectric-IED-PntRef">T:IS;L:P:302</Private>
            </DOI>
            <DOI name="Pos">
              <Private type="SchneiderElectric-IED-PntRef">T:DO;s:833;s:832</Private>
            </DOI>
```

Example 2: LDevice section of Easergy-T200I ICD file (cont.)

```
      <DOI name="SwOpCap">
        <Private type="SchneiderElectric-IED-PntRef">T:IS;L:P:302</Private>
      </DOI>
      <DOI name="SwTyp">
        <DAI name="stVal">
          <Val>2</Val>
        </DAI>
      </DOI>
    </LN>
    <LN desc="Automatic Control" inst="1" lnClass="GAPC" lnType="SE_GAPC_T200I_V001"
     prefix="">
      <DOI name="DPCSO1">
        <Private type="SchneiderElectric-IED-PntRef">
         T:DC;c:808;c:807;s:872;s:871</Private>
      </DOI>
      <DOI name="Op">
        <Private type="SchneiderElectric-IED-PntRef">T:AT;L:P:302</Private>
      </DOI>
      <DOI name="Str">
        <Private type="SchneiderElectric-IED-PntRef">T:AD;L:P:302</Private>
      </DOI>
    </LN>
    <LN desc="I/O for T200I" inst="1" lnClass="GGIO" lnType="SE_GGIO_T200I_V001"
     prefix="">
      <DOI name="Ind1">
        <Private type="SchneiderElectric-IED-PntRef">T:SS;s:912</Private>
      </DOI>
    </LN>
    <LN desc="Measurements" inst="1" lnClass="MMXU" lnType="SE_MMXU_T200I_V001"
     prefix="">
      <DOI name="zAvMes">
        <Private type="SchneiderElectric-IED-PntRef">T:MV;m:64:u1;N:-1;L:P:32</Private>
      </DOI>
    </LN>
    <LN desc="Medium Voltage Presence for T200I" inst="1" lnClass="SMVP"
     lnType="SE_SMVP_T200I_V001" prefix="">
      <DOI name="Op">
        <Private type="SchneiderElectric-IED-PntRef">T:AT;s:914</Private>
      </DOI>
    </LN>
    <LN desc="Overcurrent Phase Fault Detection for T200I" inst="1" lnClass="SFOC"
     lnType="SE_SFOC_T200I_V001" prefix="SPh_">
      <DOI name="Op">
        <Private type="SchneiderElectric-IED-PntRef">T:AT;s:896</Private>
      </DOI>
      <DOI name="RsFlt">
        <Private type="SchneiderElectric-IED-PntRef">T:DN;c:802</Private>
      </DOI>
      <DOI name="RsFltSt">
        <Private type="SchneiderElectric-IED-PntRef">T:DS;s:866</Private>
      </DOI>
    </LN>
    <LN desc=" Overcurrent Earth Fault Detection for T200I" inst="2" lnClass="SFOC"
     lnType="SE_SFOC_T200I_V001" prefix="SEF_">
                                        ...
    </LN>
    <LN desc="Medium Voltage Presence for T200I" inst="1" lnClass="ZBTC"
     lnType="SE_ZBTC_T200I_V001" prefix="">
      <DOI name="BatChaMod">
        <Private type="SchneiderElectric-IED-PntRef">T:IS;L:P:302</Private>
      </DOI>
      <DOI name="BatChaSt">
        <Private type="SchneiderElectric-IED-PntRef">T:IS;L:P:302</Private>
      </DOI>
      <DOI name="Health">
        <Private type="SchneiderElectric-IED-PntRef">T:IS;s:921;L:P:301</Private>
      </DOI>
    </LN>
  </LDevice>
```

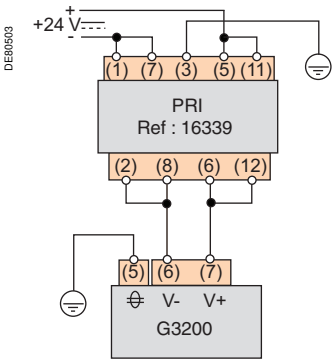
Appendix D
Powering the G3200 for surge withstand protection

In order to improve the G3200 power supply surge withstand protection and comply with the IEC 61000-4-5 Level 4, it is recommended to use a Schneider Electric surge arrester PRI (reference 16339) and to wire this equipment as described in the following sections.

The surge arrester PRI is not delivered with the G3200 and must be ordered separately, using reference 16339.

PRI surge arrester characteristics

Electrical characteristics	
Nominal operating voltage	48 V DC
Maximum discharge current	10 kA (8/20 µs wave)
Nominal discharge current	5 kA (8/20 µs wave)
Protection level	70 V
Response time	1 ns
Connection	
With cage terminals	Cables with cross-section 2.5 to 4 mm^2 (AWG 12-10)



PRI surge arrester connection.

PRI surge arrester connection

- Connect the power supply and RS 485 twisted pair using cable with cross-section ⩽ 2.5 mm^2 (⩾AWG 12).
- Connect the 24 V DC power supply and the earth to inputs (1), (5) and (3) of the PRI voltage surge protector.
- Connect outputs (2), (8) and (6), (12) of the PRI voltage surge protector to the - and + terminals of the black screen terminal block.
- Connect the RS 485 twisted pair (2-wire or 4-wire) to the (RX+ RX- or RX+ RX- TX+ TX-) terminals of the black screw terminal block. See Hardware installation, page 9.
- Connect the RS 485 twisted pair shielding to the ⏚ terminal of the black screw terminal block.
- Connect the Ethernet cable to the green RJ45 connector.

Glossary
IEC 61850 definitions

General

This glossary gives the definitions of the abbreviations used in this manual. For more information on a particular term, refer to the IEC 61850 or ISO standard listed.

IEC 61850 abbreviations and definitions

Abbreviation	Definition	IEC 61850/ISO reference
ACSI	Abstract Communication Service Interface	IEC 61850-1
BRCB	Buffered Report Control Block	IEC 61850-7-2
CDC	Common Data Class	IEC 61850-1
CID	Configured IED Description	see IED
CMV	Complex Measured Value	IEC 61850-7-3
dataNs	Data Name Space	IEC 61850-7-3
DEL	Phase to phase related measured values of a three phase system	IEC 61850-7-3
DO	Data Object	IEC 61850-1
DPC	Double Point Control	IEC 61850-7-2
DPS	Double Point Status information	IEC 61850-7-1
GOOSE	Generic Object Orientated Substation Events	IEC 61850-5
GSE	Generic Substation Event	IEC 61850-7-2
HMI	Human Machine Interface	IEC 61850-3
ICD	IED Configuration Description	IEC 61850-10
IED	Intelligent Electronic Device	IEC 61850-1
IP	Internet Protocol	IEC 61850-3
LAN	Local Area Network	IEC 61850-5
LD	Logical Device	IEC 61850-7-1
LD0	Logical Device Zero (0)	IEC 61850-7-2
LLN0	Logical Node Zero (0)	IEC 61850-7-1
LN	Logical Node	IEC 61850-1
MMS	Manufacturing Message Specification	ISO 9506
MV	Measured Value	IEC 61850-7-3
PICS	Protocol Implementation Conformance Statement (ISO/IEC 8823-2:1994)	IEC 61850-7-2
PIXIT	Protocol Implementation eXtra Information for Testing	IEC 61850-7-2
PP	Phase to Phase	IEC 61850-7-4
PPV	Phase to Phase Voltage	IEC 61850-7-4
RTU	Remote Terminal Unit	IEC 61850-4
SBO	Select Before Operate	IEC 61850-9-1
SDO	Sub DATA within a DOType	IEC 61850-6
SCADA	Supervisory Control And Data Acquisition	IEC 61850-3
SCD	Substation Configuration Description	IEC 61850-10
SCL	Substation Configuration description Language	IEC 61850-1
SNTP	Simple Network Time Protocol	IEC 61850-8-1
SPC	Single Point Control	IEC 61850-7-4
SPS	Single Point Status information	IEC 61850-7-1
TCP	Transmission Control Protocol	IEC 61850-3
VLAN	Virtual Local Area Network	IEC 61850-9-2
XML	eXtensible Mark-up Language	IEC 61850-1

Notes

Notes

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